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ABSTRACT

This eighth annual report considers the state of the environment and new or continuing efforts to improve it. The publication is divided into two chapters. The first chapter summarizes important environmental events of the past year. Events include new legislation, court rulings, major accidents, policy changes, and similar material. The second chapter summarizes conditions and trends. Data are presented and discussed in this section to illustrate improving or degrading environmental conditions. In chapter one, the major sections are pollution, energy, natural resources, human settlements, and NEPA. Under the pollution section, events relating to toxic substances, air, water, solid wastes, and noise pollution are considered separately. In chapter two the major sections are air quality, water quality, environmental health, energy, non-renewable resources, population and human settlements, and economics. Appendices present presidential actions, Council on Environmental Quality projects, and other environmental information of the past year. (MR)

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environmental quality-1977

the eighth annual report of the council on environmental quality

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

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december 1977

SE 024 304

THE PRESIDENT'S MESSAGE

To the Congress of the United States:

In 1977, we took together a number of important measures to protect and improve our environment. Most notable were the "mid-course correction" amendments that strengthened the basic goals of our air and water pollution control laws; a strong stripmining bill; and our selection, with Canada, of the least damaging route for a natural gas pipeline from Alaska to the lower 48 states.

The Administration began reviews of traditional policies on our use and development of natural resources, especially water and non-fuel minerals; put into effect new policies to reduce oil spills and regulate development of oil and gas on the Outer Continental Shelf; proposed expansions of wilderness and park areas; started work on a coherent Federal strategy for the control of toxic substances; and advocated measures to curb nuclear proliferation. On some of these matters we submitted legislative proposals to Congress.

We share a record of solid accomplishment in the environmental area, and we have set out worthwhile plans for the future.

In June, 1977, the Council on Environmental Quality convened a series of meetings at my direction. The purpose was to dvelop recommendations for improving National Environmental Policy Act procedures, including the familiar "environmental impact statement." CEQ solicited testimony from corporations, state governments, labor unions, environmental groups, other Federal agencies, and the public.

Virtually every witness criticized some aspect of the Government's procedures for translating environmental policy into practical action. But, remarkably, *not a single witness* called for the repeal or serious weakening of the National Environmental Policy Act. On the contrary, all agreed that the goals of NEPA were sound, and that its procedures—while needing improvement—should be retained.

Such unanimity on the value of NEPA indicates to me how far we have come in those few years since we first began to see the damage we were doing to our surroundings. Not long ago, environmental awareness was frequently seen as an emotional excess and an economic disaster. But now, concern for the integrity of our natural systems has become an accepted criterion for judging our actions.

We have not yet learned, of course, to balance all our environmental objectives against the other social goals that must concern us. But it is now clear that the American people believe our needs for food, for shelter, and for the necessities as well as the amenities of civilization can be met without continuing the degradation of our planet. It is clear that they wish, as Congress stated in the National Environmental Policy Act, "to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans."

In less than a year, this Administration and this Congress have substantially advanced the American search for "productive harmony" with our earth. I pledge to continue this search with you.

Jimmy Carter

JIMMY CARTER.

THE WHITE HOUSE.

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL ON ENVIRONMENTAL QUALITY
722 JACKSON PLACE, N. W.
WASHINGTON, D. C. 20006

LETTER OF TRANSMITTAL

THE PRESIDENT:

Sir: The Council on Environmental Quality herewith submits its eighth Annual Environmental Quality Report in accordance with Section 201 of the National Environmental Policy Act of 1969 (42 U.S.C. 4341).

Respectfully,

Charles Warren

Charles Warren
Chairman

Gus Speth

Gus Speth
Member

Marion Edey

Marion Edey
Member-Designate

HIGHLIGHTS

CHAPTER 1 EVENTS

POLLUTION

Toxic Substances

- Until the Toxic Substances Control Act of 1976 was passed, there was simply no way to assess or control the development, production, and marketing of the flood of manmade chemicals. (p. 1)
- [T]he new law . . . gives the government broad authority to control the production, distribution, and use of *all* potentially hazardous chemicals. It provides for testing of suspect chemicals before they become widely used and economically important. It emphasizes collection of information and freedom of access to research data so that the scientific community can note and assess potential problems. (pp. 2–3)
- *Total* human impact and *total* effect on the environment are the key factors in developing a rational approach to handling hazardous substances. (p. 4)
- Of some 70,000 chemicals in commercial production, the *number* of carcinogens—in particular, the number to which there is widespread population exposure—may be quite small. Nevertheless, because exposures are thought by many cancer researchers to have irreversible and additive or synergistic effects, widespread exposure to even low levels of individual chemicals is of grave concern. (p. 5)
- In recent months constructive efforts have been made to assemble new mechanisms for focusing, coordinating, and otherwise improving research on potential environmental hazards . . . . (p. 7)
- The Food and Drug Administration has proposed new regulations for toxicological studies of food and drug products. The . . . proposal was prompted by the discovery that required industry-sponsored tests often suffer serious deficiencies. (p. 7)
- Decisions to regulate carcinogens often involve controversial policy judgments about how to deal with scientific and medical uncertainties. More often than not the issues are repetitively argued for each individual chemical as it becomes the subject of regulatory proceedings, but general principles for identifying, classifying, and regulating potential carcinogens have recently been proposed by several government agencies. (p. 9)
- In May Secretary of Labor F. Ray Marshall announced new priorities for OSHA that will follow a "common sense approach" to health and safety and will avoid "nitpicking" regulations and enforcement. (p. 10)
- Regulations proposed by the FDA, Consumer Product Safety Commission, and EPA in April are phasing out all nonessential aerosol uses of fluorocarbons —11 and —12. (pp. 10–11)

- [P]rimary standards to protect human health from organic, inorganic, and microbiological contaminants and for turbidity in drinking water became effective in June 1977. . . . EPA has not yet established primary drinking water standards for organic chemical contaminants. (pp. 12–13)
- [T]he disastrous effects of Kepone contamination of the James River and the surrounding Chesapeake Bay area continue. (p. 15)
- EPA added benzene to the list of hazardous air pollutants in June. (p. 16)
- The sale of lead paint for most consumer uses and its use on any toys, furniture, and other household products will be prohibited after February 28, 1978 . . . . (p. 18)

Air

- After 3 long years of effort in the Congress, the 1977 Amendments to the Clear Air Act were signed into law by the President in August 1977. The Amendments . . . did not strike out in bold, new directions [but] slightly modified existing programs. [T]hey were passed in time to allow the automobile manufacturers to market their 1978 models. (p. 22)
- The deadline for the required reduction in automobile emisisons . . . was further extended to 1980 for unburned hydrocarbons and to 1981 for carbon monoxide by the 1977 Amendments. In addition, the required nitrogen oxide (NO_x) control has been slightly modified. (p. 22)
- The issue of how much to protect air quality in regions that are already cleaner than the ambient air quality standards was also the subject of extended debate. This is a key issue in many western states where clean air is highly valued but where there is also strong pressure to develop the region's coal resources—development that might be curtailed if the air quality standards were too strict. (pp. 23–24)
- Under the 1970 Amendments no provision was made to allow construction of new sources or substantial expansion of old sources in air quality control regions that exceeded ambient air quality standards after 1975. The lack of such a provision could effectively have stopped all economic growth in many urban areas. EPA had previously proposed an "emission offset policy" to deal with the problem. In slightly modified form, this policy was adopted in the 1977 Amendments. (p. 24)
- [T]he Clean Air Act Amendments aim to make enforcement fairer and more effective while avoiding excessive impacts on energy use or the economy. (p. 25)

Water

- In the first phase of the cleanup program mandated by the FWPCA, $18 billion of federal grants was authorized to help municipalities develop effective pollution controls for waste water. (p. 27)
- There are increasing delays in beginning construction once a grant is awarded; some states are running out of federal funds while others are having trouble spending their share; there is continued concern whether the money is being spent in the most cost effective manner—particularly when used for tertiary treatment facilities and capital intensive facilities in small communities. (pp. 27–28)
- [In small communities, the] cost per person served . . . is $580, compared to $185 per person for communities with more than 25,000 people. (p. 33)
- [O]nly 33 percent of municipal waste water facilities [were expected to] comply with secondary treatment requirements by the July 1, 1977, deadline. (p. 36)

- In the summer of 1976 EPA proposed stringent toxic pollutant effluent standards for six substances . . . : aldrin/dieldrin, DDT, endrin, toxaphene, benzidine, and PCB's. [F]inal standards were promulgated during January and February 1977. (p. 40)
- In January 1977, EPA ruled that all sludge and industrial waste dumping in the Atlantic Ocean must end by December 31, 1981. (p. 42)
- [T]he Administration proposed amendments to the Federal Water Pollution Control Act [which] focused on the efficiency of the municipal grants program, enforcement tools, and the specific issues of controlling toxic pollutants and protecting wetlands. (pp. 43-44)
- [T]he Administratoin did not support any extension in the deadlines. However, EPA has committed itself to reviewing and, if necessary, revising the best available technology guidelines to ensure that the cost of removing additional nontoxic pollutants is consistent with the benefits that would be expected to result. (p. 44)
- The amendments suggested for the municipal grants program included an incentive for water conservation and elimination of separate storm sewers, collector sewers, and sewer rehabilitation from eligibility for federal funding. . . . Long-term funding was linked to progress in controlling nonpoint source pollution, imposing effective pretreatment requirements in municipal systems, and other requirements listed in Section 208. (p. 44)

Solid Wastes

- The Resource Conservation and Recovery Act (RCRA) . . . promotes resource recovery and conservation and mandates government control of hazardous waste from its generation to ultimate disposal. (p. 45)
- The problem of hazardous waste has grown to serious proportions in recent years . . . . (p. 45)
- [G]round water contamination is the most common damage reported [from improper hazardous waste disposal] followed by surface water contaminayears . . . . (p. 45)
- The technology for environmentally sound treatment, storage, and disposal of hazardous waste is generally available. It . . . can cost 10 to 40 times as much as the unsatisfactory methods in current use—dumping, ponding, and burial without adequate safeguards. (pp. 47-48)
- [RCRA] requires a federal or state regulatory, inspection, and enforcement program in every state. However, it encourages the states to accept these and other solid waste responsibilities under federal guidance and provides financial and technical assistance to help them do so. (p. 49)
- In addition to the 20 to 50 million tons of solid waste that could be classified as hazardous under RCRA, several billion tons of other solid waste are generated annually. . . . These too are a potential threat to the environment and public health if they are not properly disposed of. (p. 50)
- State and local governments exercise very little control over the numerous land disposal sites for solid waste. Of an estimated 16,000 municipal land disposal sites, only about 5,800 were recognized as complying with state regulations in 1976. (p. 50)
- Most resource recovery is still done through the separation of recyclable materials from other wastes by householders, office workers, and others at the sources of waste generation. Of the roughly 9 million tons of materials recycled per year, more than 90 percent is wastepaper. (p. 54)

- Over the next decade almost every city and industry will have to face the increasingly difficult task of disposing of sludge from municipal waste water treatment plants. As these plants are upgraded, the task of sludge disposal grows. (p. 56)

Noise

- EPA's first comprehensive national plan for reducing noise was released by EPA administrator Douglas Costle in May 1977. . . . Its chief goals are to eliminate hearing loss resulting from noise exposure, to reduce 24-hour average noise levels immediately to no more than 75 decibels, to achieve reductions to 65 decibels by vigorous regulatory and planning action, to strive for eventual reductions to 55 decibels, and to help other federal, state, and local agencies adopt and implement long-range noise control policies. (pp. 57–58)
- FAA's new aircraft noise regulations will require all aircraft, regardless of production date, to meet the 1968 aircraft noise standards during a phased schedule of 8 years. (p. 58)
- An April 1977 report for Concorde operations at Dulles International Airport confirms forecasts that the plane is noisier than conventional aircraft. (p. 60)

ENERGY

- After 2 years of lower consumption, U.S. energy use in 1976 rebounded with the recovering economy, rising by 4.8 percent to 74.0 quadrillion Btu's. Demand for oil increased 6.6 percent and natural gas consumption was up 1.3 percent. While consumption rose, domestic production dropped. (p. 61)
- The President's National Energy Plan, submitted to the Congress in April 1977, . . . is intended to provide a smooth transition into the era when the world's oil will become far more scarce and costly. (p. 62)
- Several bills to change the 24-year-old OCS Lands Act are currently before the Congress. . . . The amendments would permit separate leases for exploration and for subsequent development and production . . . . Leases could be cancelled where there is likelihood of serious environmental harm and where the advantages of cancellation outweigh those of continuing operations. The role and authority of state and local governments in the leasing program are more fully defined . . . . (p. 63)
- Secretary of Interior Cecil Andrus has substantially revised the OCS leasing schedule [which] is based upon goals of increased production from offshore areas, high standards of environmental protection, and adequate consultation with affected states and time for planning. (pp. 63–64)
- President Carter's program to reduce oil pollution from tankers . . . included measures to deal with accidental spills and with pollution from normal operations such as deballasting and tank cleaning. It is also intended to improve cleanup after oil spills and to provide full and dependable compensation to victims of oil pollution damage. (p. 64)
- [O]ne-quarter to possibly one-half of the oil flowing from Valdez, Alaska, by late 1978 will be surplus on the west coast. (p. 66)
- One alternative for delivering North Slope oil is the . . . proposal to land 500,000 barrels per day at Long Beach, California, and transport it to Midland, Texas, by an existing gas pipeline . . . . The chief argument against the . . . proposal is the threat to air quality. (p. 66)
- Large amounts of natural gas are present in the petroleum-rich North Slope. . . . The three competing transportation routes . . . would [all] inflict

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significant environmental damage, but the impacts differ substantially in kind and degree. More fundamentally, they raise questions about our ability to preserve the wilderness and culture of the Far North in the face of growing demands for energy. (p. 68)

- In April President Carter announced a major redirection of [nuclear] policy, proposing to avoid nuclear proliferation and postponing use of plutonium as a commercial fuel. The National Energy Plan [counts] on nuclear power to meet a share of our energy needs but emphasizes increased attention to reactor safety, siting, licensing, and waste management. Meanwhile, financial difficulties continued to trouble the nuclear power industry in the past year, and growth projections were again revised downward. (p. 71)
- In August 1976, for the first time, there was civil disobedience in the antinuclear movement, and two demonstrations at Seabrook resulted in 117 arrests. (p. 74)

NATURAL RESOURCES

- [T]he 94th Congress passed several long-awaited measures for conservation and balanced management of natural resources. The Bureau of Land Management . . . was finally given legislative direction and strong authority by the Federal Land Policy and Management Act of 1976. The National Forest Management Act of 1976 permanently established the National Forest System and gave extensive guidance for its management. . . . The Congress and the states also added to the Wilderness and Wild and Scenic Rivers Systems. (pp. 75–76)
- Under terms of the Alaska Native Claims Settlement Act, the Congress is to consider designation of major additions to the National Park, Forest, Wildlife Refuges, and Wild and Scenic Rivers Systems. (p. 79)
- [T]he Department of the Interior['s] "Preliminary Urban Parks Study" . . . recommends changing the Land and Water Conservation Fund grant formula to be more responsive to urban needs. (p. 81)
- ORV users are a small percentage of the total population, but the resource damage that they cause is out of proportion to their numbers. ORV's have invaded a variety of lands—from deserts and coastal sand dunes to forested mountains and fertile plant and wildlife habitats. . . . In addition to causing plant destruction, soil erosion, and gullying, ORV's can adversely affect soil moisture, water quality, and wildlife habitat. (pp. 82–83)
- At the 29th meeting of the IWC in 1977, member countries agreed to a cutback of 10,211 whales for the 1977 quota, complete protection of Bowhead Whales . . . and new quotas to include all species of large whales . . . . (p. 83)
- In much-publicized cases last year, plans to build dams came into conflict with endangered animals and plants. . . . In Tennessee, the Tellico Dam was halted by court order because it would destroy the last available habitat for the Snail Darter, a small freshwater fish. An endangered flower, the Furbish Lousewort, was found within the impoundment area of the proposed Dickey-Lincoln reservoir in Maine. (p. 85)
- Since June 1976, 34 Wilderness Areas comprising 1.7 million acres have been added—a banner year in which more acreage was added than in any 12 months since passage of the Wilderness Act. (p. 85)
- There are now 19 rivers protected by the Wild and Scenic Rivers System . . . . An additional 51 rivers are either under study or have been studied and proposed. (p. 87)
- Hard rock mining on public lands is still governed by the Mining Law of 1872. [I]t does not provide for balanced use of the federal lands but

allows mining to preempt other uses, it provides for conveyance of mineral lands out of federal ownership rather than for leasing them subject to rental and royalty payments, and it does not provide adequate control of environmental damage from mining on the public lands. (p. 89)

- More than 8 million acres of prime U.S. farmland was converted to urban development, reservoirs, and other uses from 1967 to 1975—an average net loss of 1 million acres per year. Losses in the southeast and Corn Belt regions were most severe, accounting for 3 of the 8 million acres. . . . The greatest losses of prime farmlands are occurring in areas with minor environmental and management problems . . . . (pp. 90–91)
- Erosion of topsoil from farmlands is severe enough to threaten continued crop productivity despite federal expenditures for soil conservation of nearly $15 billion since the 1930's . . . . (p. 92)
- Throughout much of the West and parts of the Midwest, the major environmental event of the year was the drought. (p. 93)
- Ground water, which provides one-fourth of the nation's freshwater, had already been seriously depleted in parts of the Midwest and Southwest and is now being further mined or overdrawn for irrigation and municipal water supplies. (pp. 94–95)
- A federal task force on water conservation is preparing . . . detailed options and recommendations as part of a comprehensive review of water resources policy. (p. 96)
- Soon after taking office, President Carter initiated a major interagency review of federal water resource projects and announced his intention to develop comprehensive water policy reforms and to oppose construction of projects which fail to meet minimum economic, environmental, and safety criteria. (p. 96)
- [A] new Executive order on Floodplain Management . . . restricts federal executive agencies from undertaking, supporting, or allowing construction and other incompatible development in floodplains unless the agency makes a formal finding that no practicable alternative exists. (p. 98)
- [A]n Executive order requir[es] all federal executive agencies to refrain from supporting construction in wetlands wherever there is a practicable alternative. (p. 98)

HUMAN SETTLEMENTS

- Many problems of rapid growth that plagued cities and suburbs in the fifties and sixties are reappearing in small towns and rural settlements, especially where energy-based growth booms are occurring. (p. 100)
- [O]ther efforts were directed to conserving and revitalizing communities and neighborhoods that are in a state of decline. (p. 105)
- New laws—the Tax Reform Act of 1976, the Public Buildings Cooperative Use Act, and provisions in several others—provide for neighborhood conservation.

  The Internal Revenue Code's long-time bias against preserving historic buildings was largely corrected by the Tax Reform Act of 1976. (p. 106)
- The need to coordinate . . . planning efforts at all levels of government has long been apparent, and the new Administration supports legislation directed to this need. . . . Denver is an example of this integration. (p. 108)
- As states complete their coastal zone management plans, interpretation of the federal consistency provision of the Coastal Zone Management Act becomes the subject of rigorous debate. (p. 109)

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- States and environmental organizations generally insisted on broad definitions covering as much as possible under the consistency umbrella: federal agencies sought to define the terms more narrowly. The Office of Coastal Zone Management in the Department of Commerce played a mediating role. (p. 110)
- [T]he oil and gas industry criticized California's draft program on the grounds that it offered only principles and guidance to local governments, which make the land use decisions, subject to state approval. The industry argued that California had not provided for energy facility siting although the law expressly requires that such uses be considered. (p. 110)
- The Fishery Conservation and Management Act of 1976 . . . provides for the setting of fish catch quotas by species on the basis of an ecologically sound optimal yield in order to rebuild and sustain these valuable food stocks. (p. 112)
- [T]he U.N. InterGovernmental Maritime Consultative Organization [has] taken up the Presidential proposals for improved construction and equipment features, including segregated ballast and inert gas systems . . . , improved inspection and enforcement of pollution laws against substandard vessels, and better training and standards for crews. (p. 112)
- The United States is working within OECD and bilaterally to harmonize international regulation of toxic substances. . . . UNEP urged nations not to permit the export of potentially harmful chemicals that are unacceptable domestically without the knowledge and consent of authorities in the importing country. (pp. 114–15)
- . . . President Carter instructed all officials concerned with development assistance to ensure that environmental soundness is integral to their consideration of projects. (p. 115)

NEPA

- In his Environmental Message, President Carter said that NEPA's effect had been dramatic and beneficial in the 7 years since its passage, but he also emphasized the need to reduce the paperwork and increase the usefulness of environmental impact statements. [H]e directed CEQ to issue regulations, binding on all federal agencies, to implement NEPA and guide the EIS process . . . . (p. 116)
- Problem areas . . . included how to focus on real issues and alternatives and make impact statements more useful to decisionmakers and the public; how to streamline the process and to eliminate conflicts, duplication, and paper production; and how to emphasize substance over procedure and implement NEPA's purpose—protecting the quality of our environment. (p. 117)
- The most significant court decisions on NEPA during the past year concerned comprehensive program impact statements. . . . In *Swain* v. *Brinegar*, the U.S. Court of Appeals for the Seventh Circuit . . . reaffirmed the necessity to prepare a program impact statement if an individual action is an integral part of a larger federal program and completion of the individual action could foreclose later project alternatives. (p. 119)
- In the *Vermont Yankee* nuclear powerplant case, the U.S. Circuit Court of Appeals for the District of Columbia held that the NRC must consider the environmental effects of reprocessing and disposing of radioactive wastes in an EIS *before* granting an operating license for a nuclear powerplant. (p. 120)
- Since NEPA's enactment, five Circuit Courts of Appeals have explicitly adopted the position that NEPA imposes substantive requirements on federal agencies. (p. 121)

- . . . NEPA cases ending in court are a small proportion of the many thousands of federal actions assessed for environmental impacts. (p. 122)
- Actions delayed by injunctions granted under NEPA amount to only 177 cases in 6½ years . . . . This figure is less than 3 percent of the 7,334 actions for which impact statements were prepared and a much smaller proportion of the unknown—but very large—number of assessments made. (p. 123)

CHAPTER 2 CONDITIONS AND TRENDS

AIR QUALITY

- Based on the levels of the five major "criteria" pollutants present in the air, the nation's air quality is improving. (p. 151)
- Only the south coast basin of California, the Houston-Galveston area, and Philadelphia are likely to be significantly above the ambient ozone standard in 1990. Five other cities are projected to have a marginal problem in terms of the number of days the ambient standard is exceeded. (p. 151)
- Rapid conversion to use of coal has the potential for worsening air pollution, both globally and locally, and must be carefully watched. (p. 152)
- Scrubbers and particulate control systems can substantially reduce local effects of sulfur dioxide and particulates, but rapid growth and heavy use of coal regionally may create serious air quality problems that are not covered by the present standards for criteria pollutants. (p. 152)
- Carbon monoxide and photochemical oxidants are the main air pollution problems in most U.S. cities. (p. 152)
- [I]t appears that the risk will be greater for ozone than for carbon monoxide. The reasons are several: The areas experiencing ozone violations are much larger and their populations much larger than the places where the CO standard is being exceeded. There are more known health effects for ozone and therefore the population at risk is larger. (pp. 168–69)
- Strong control programs for particulates and sulfur dioxide, in effect in the last few years, have reduced emissions to the point that very few urban regions are now experiencing violations of the standards for these pollutants. (p. 169)
- It will be easier to meet the carbon monoxide air quality standard than the oxidant standard, principally because the CO problem is very localized and automobiles are the predominant source. . . . The 16 cities with the worst problems should achieve the standard by 1990, with only a few violations remaining in 1985. (pp. 182–83)
- Air quality projections based on the current annual average standard indicate that only Los Angeles will remain significantly above the [CO] standard in 1990. Boston, Chicago, and Philadelphia are expected to be slightly above the standard. (p. 186)
- Several global air pollution problems of international concern are the carbon dioxide "greenhouse" effect, the turbidity effect, and the potential depletion of the stratospheric ozone layer. A most important subglobal problem is acid rain in Scandinavia and North America. (p. 188)
- If we use up the world's stores of fossil fuels at a rapid rate, the predicted CO_2 level will double by 2025 and reach a maximum of seven to eight times today's level by the year 2100. A doubling of the CO_2 level could cause a 2–3° C increase in average atmospheric temperatures. . . . A possible 2–3° C average temperature increase must be looked upon as a major global environmental threat . . . . (p. 190)

- [Fluorocarbons] may attack the earth's protective outer layer, damaging human health, individual biological species, and ecological systems and possibly causing climatic change. (p. 193)
- Potential fluorocarbon impacts on climate are very important. Fluorocarbons may prove second only to CO_2 emissions as a significant problem of global scale. (p. 195)
- Recognition of the threat of acid precipitation in the United States has been slow. (p. 197)
- Current SO_2 and NO_2 standards are directed at protecting health in urban or industrial environments. Standards related to acid precipitation are lacking because definitive assessment information does not yet exist. (p. 198)

WATER QUALITY

- In recent years we have launched efforts on an unprecedented scale to restore and protect water quality, and . . . there is cause for encouragement in the many important accomplishments achieved thus far. (p. 199)
- Even if the 1977 deadlines had been fully met, the 1983 "fishable and swimmable waters" goal and other water quality needs are a long way away. (p. 199)
- [Fifty] water bodies . . . have been greatly improved since the 1960's through federal, state, municipal, or private efforts. (p. 200)
- Fish have returned to western Connecticut's Naugatuck River, even where no aquatic life could survive in the 1950's. (p. 200)
- State water quality standards for protection of aquatic life are now being met throughout Alabama's lower Tombigbee River, including a 5-mile stretch near McIntosh that was once known as the "fish kill capital of Alabama." (p. 202)
- For all 334 NASQAN subregions, the average violation rates for fecal coliform bacteria were 38 percent in 1975 and 31 percent in 1976. . . . Future data will tell us to what extent the apparent improvements from 1975 to 1976 represent genuine trends. (pp. 207–208)
- [T]he safe swimming limit for fecal coliform bacteria is often violated—more than one-half the time downstream, on the average, for all study areas. (p. 211)
- For dissolved oxygen, most of the municipal study areas had low violation rates—below 10 percent during the entire 9 years on the large streams evaluated in our study . . . . (p. 212)
- CEQ's benchmark level for biochemical oxygen demand [was] exceeded in 10 percent or more of the measurements at only 8 of the study areas during any time period in the study . . . . (p. 217)
- Sanitary water quality has significantly improved in most of the municipal study areas in the past 9 years, largely because of actions taken prior to enactment of P.L. 92–500. Severe pollution is still prevalent, with water quality criteria for bacterial levels being violated more often than not downstream of the cities. (pp. 226–27)
- The cities have a long way to go to meet P.L. 92–500 requirements. (p. 227)
- [T]he present mechanism for allocating grant funds does not always provide federal funding on a priority basis to cities which appear to merit it. (p. 227)
- Much new construction will be required to serve a larger proportion of the population with adequate sewage treatment. (p. 227)

- [R]ecent reports of significant levels of toxic substances in U.S. waters have been disturbingly consistent.

  Toxic pollutants will probably pose the nation's most important water pollution problems in the future. (p. 227)

- Although the total volume [of oil] spilled was greater in 1976–77 than in any other year except 1970–71, more than one-half of the 1976–77 total was from the *Argo Merchant*. . . . In terms of the total number of incidents 1976–77 was not an unusual year. (p. 233)

- Approximately 1 billion pounds of synthetic organic pesticides are used in the United States each year. If this quantity were blanketed uniformly over the entire U.S. land area (3.6 million square miles), about 275 pounds of active pesticide ingredient would be deposited on each square mile of land each year. (pp. 235–36)

- The most significant finding of the [three-state] study was the prevalence in water samples—and even more so in stream sediment samples—of several pesticides that had been cancelled or restricted. . . . [T]he detection rate for the Houston area was 68 percent. These high rates of detection leave open the possibility that the chemicals are still being used in residential areas, although a more likely explanation is that the sediments in some shallow bayous contain residual contamination that affects the water column measurements. (p. 239)

- [P]ollution by chlorinated hydrocarbon insecticides has declined in recent years. . . . Nevertheless, it is apparent that persistent pesticides still constitute an important source of contamination of the nation's water. (p. 240)

- Toxic metal pollution was cited by 35 of the 41 states that reported water quality problems to EPA in 1976. (p. 240)

- PCB residues exceeding the FDA tolerance level are being found in fish tissues from three of the Great Lakes, and eight states presently regard PCB contamination as one of their most important water pollution problems. It will take many years for the present levels in fish tissues and bottom sediments to drop substantially. (p. 241)

- Over the entire length of the [Ohio River], an average of 35 percent of all phenol measurements in 1976 exceeded the 1 microgram-per-liter criterion EPA recommends for protecting water supply sources. The more serious level of 5 was violated 13 percent of the time. (p. 247)

- Immense as they are, the Great Lakes are subject to eutrophication and other grand-scale alterations caused by human activity. Thus far, the open waters of Lakes Superior, Michigan, and Huron are still generally good as judged by federal water quality criteria and state standards. However, the lower Great Lakes—Erie and Ontario—show signs of significant degradation even in their offshore waters, and the upper lakes exhibit early signs of undesirable alteration. (p. 251)

- Although it is still the most degraded of the Great Lakes, Lake Erie's loadings of sewage, phosphorus, phenols, mercury, chloride, and other pollutants have been significantly reduced in the past few years. (p. 251)

ENVIRONMENTAL HEALTH

- **Using both maps and statistical techniques, the Council finds confirmation for reports that death rates from cardiovascular disease tend to decrease as the "hardness" of drinking water increases. (p. 253)**

- **[T]he effects of drinking water on heart disease, though generally consistent and predictable, may be small compared with such well-established risk factors as nutrition and socioeconomic status. (p. 253)**

- Chlorinated organic compounds are numerous among the known and suspected carcinogens found in drinking water. (p. 254)

ENERGY

- The choice of technologies to meet the need for alternative energy sources is now the subject of intense debate, and two opposing points of view have emerged—the "hard" and the "soft" energy paths to the future.

  The "hard" path opts for redoubled efforts to develop all current energy sources, with a highly centralized, highly electrified energy future.

  The "soft" path embodies the fundamental view that nature imposes limits on growth and that it is possible to live comfortably within those limits. Conservation is an indispensable part of this approach [which] emphasizes renewable, relatively nonpolluting, often decentralized, and small-scale sources of energy. (p. 273)
- Both institutional problems and social and political factors tend to discourage wide adoption of district heating—the central distribution of heat to offices, stores, apartments, and other nearby buildings. (p. 279)
- Many institutional problems of solar heating and cooling involve building codes and other land use controls. (p. 279)
- For many forms of solar energy, the difficulty is cost. Here the prospects are reasonably encouraging. [A]lthough photovoltaic cells are very expensive for most applications, their costs have dropped by one-half in the past 2 years. (p. 280)
- Electricity generated from coal . . . is underpriced compared with solar electric energy unless it includes the full environmental costs of producing and burning the coal. (p. 280)
- [S]ome small- or intermediate-scale solar technologies fit energy needs in developing countries and are less costly than available alternatives. (p. 280)
- In this country, it may be economically feasible, now or very soon, to use solar devices for production of electrical or mechanical energy in remote places where conventional energy is very expensive. (p. 281)
- Solar and many other nonconventional technologies were long at a disadvantage for federal research funds. (p. 281)
- [The] use of any form of solar energy in a steady state system would lessen the long-term worldwide buildup of atmospheric carbon dioxide. In a steady state system, CO_2 would be used for photosynthesis at the same rate it would be produced in combustion. (pp. 291–92)

NONRENEWABLE RESOURCES

- Advances in living standards . . . have rested upon the availability and exploitation of natural resources. But their consumption by the developed world has grown so rapidly that concerns are being voiced about nature's bounty running out, especially as developing countries attempt to match the living standards of the developed world. (p. 292)
- Some renewable materials are far more significant than their small percentages suggest, and they may well replace those which are becoming scarce, are exceptionally energy consuming, or are imports. (p. 292)
- Assuming that environmental safeguards and technical developments will make it practical for coal and other energy resources to replace dwindling supplies of petroleum and natural gas, world supplies of nearly all minerals and materials now in use should suffice to meet projected needs through the year 2000 and well beyond. (p. 295)

POPULATION AND HUMAN SETTLEMENTS

- The declining fertility rates and regional population shifts of the past few years continued through 1976, setting new records. . . . [F]or the first time since the first U.S. Census in 1790, the population of the South and West equalled that of the North—indeed, slightly exceeded it. (p. 301)
- In the 5 years 1970–75, the population increased 6.3 percent in nonmetropolitan areas and only 3.6 percent in metropolitan areas . . . . In large part this migration is growth on the metropolitan fringes rather than a genuine movement back to the country. (pp. 303–304)
- World population exceeded 4 billion in March 1976, having added the last billion in 15 years. The next 1 billion is expected in about 13 years. (p. 306)
- Although the rate of growth is expected to decrease gradually, the 1970's will experience more population growth than any other decade in history—over 800 million, 88 percent of them in the Third World. (p. 307)
- Despite the obvious deterioration of housing and neighborhoods in sections of U.S. cities, both quantity and quality of our housing stock have generally improved in the past 3 decades. (p. 308)
- With increased housing prices, interest in rehabilitating existing housing has increased. (p. 312)
- The high priority given to rehabilitation is reflected in the growing demand for home improvement loans to households. (p. 315)
- Higher incomes and more leisure time have increased the demand for recreation, particularly in urban areas. The problem with satisfying this demand is usually not a lack of available park space but rather accessibility, maintenance, and operation of the space. (p. 317)
- Access to parks was identified as a serious problem for inner-city residents. Ninety percent of the visitors to the new Gateway National Recreation Area in New York arrive by automobile—in a city where one-half the households have no car. (p. 317)

ECONOMICS

- [T]he proportion of plant and equipment expenditures for pollution abatement has not increased substantially in the last 5 years. (p. 321)
- With increased investment come increased operation and maintenance costs. . . . O&M costs for manufacturers . . . are running one-third to one-half the total investment expenditures. (pp. 321–22)
- CEQ estimates that the nation spent $40.6 billion for pollution control in 1977, approximately $187 per capita. Of this amount, only $18.1 billion is in respone to environmental legislation, and the remainder would have been spent in the absence of such legislation. (p. 323)
- [W]e have made important improvements in our environment and are realizing such economic benefits as lower expenditures for health maintenance and for protection, maintenance, and repair of property as well as such nonmonetary benefits as improved recreational opportunities, clearer views, and other esthetic and psychological improvements. (pp. 326–27)
- [T]he benefits are expected to exceed the costs substantially. . . . [B]ecause of the time required to install pollution control devices and the lag in phasing out older automobiles and older facilities that pollute, benefits are expected to lag behind these abatement expenditures. (p. 327)
- [T]he year's projection of incremental abatement costs (the additional costs resulting from federal environmental regulations beyond what would

have been spent in the absence of environmental legislation) totals $289.1 billion for 1976 through 1985. Fifty-three percent, $153 billion, is for air pollution control and 40 percent, $117 billion, is for water pollution control. (p. 327)

- [E]nvironmental programs are not expected to have a major impact on the economy. (p. 332)
- [T]here were 677,900 people employed directly for pollution abatement in 1974. Since then the number has probably increased because of the increased pollution abatement expenditures. (p. 332)

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CHAPTER 1

EVENTS

POLLUTION

TOXIC SUBSTANCES

Protection of environmental quality is no longer in its infancy. In the 8 years since the Council has reported on our environment, the nation has made strenuous efforts to control pollution, use land wisely, protect the physical and social fabric of communities, and preserve a magnificent natural heritage.

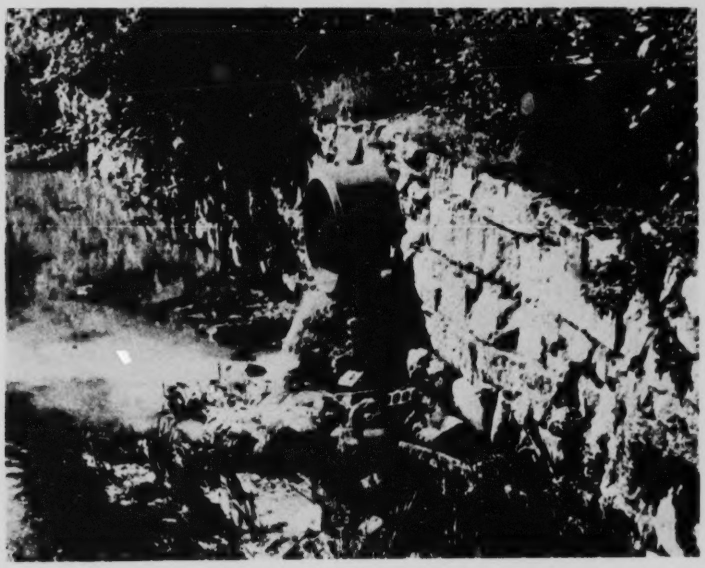
Some of these efforts have achieved a large measure of success. There have also been failures and compromises. And sometimes there have been adverse, unexpected effects from well-meant programs, for example, the urban sprawl generated by overambitious sewer projects which drew their inspiration and funds from the federal program to clean up the nation's waters.

The successes that we have recorded in this and earlier reports are gratifying, but even the half-successes and failures are a necessary part of our environmental learning. Through trial, evaluation, correction, and persistence toward our goals, we are progressing.

In one area—a vitally important one—we are just beginning. Until the Toxic Substances Control Act of 1976 was passed, there was simply no way to assess or control the development, production, and marketing of the flood of manmade chemicals. Many of these complex chemicals do a great deal of good and little harm, but some are among the most toxic and persistent substances ever introduced into our environment.

Unhappily, the toxicity and persistence of chemicals have often been discovered *after* their widespread use and *after* they have become important to jobs, commerce, or agriculture. For example, the dangers of PCB's were well known, and remedial measures were proposed by a federal task force in 1972. Indeed, every year since, the Council's Annual Report has called attention to the continuing hazards of this group of chlorinated hydrocarbon fluids. Several federal laws dealing with toxic and hazardous chemicals were in existence, but none was adequate to control PCB's. Despite a voluntary commitment by industry to restrict sales, millions of pounds of the chemical continued to enter the environment every year, and evidence of PCB contamination is widespread.

The Toxic Substances Control Act of 1976[1] specifically and finally puts an end to the use of PCB's, setting January 1979 as the last date when the chemical may be produced and July 1979 as the last date for its sale. (Of course, years will pass before the sediments of rivers, lakes, and coasts will be free of this persistent chemical.)



An outfall emptying untreated municipal and industrial waste into the Little River near Woodbridge, Connecticut.

But the major accomplishment of the new law is that it gives the government broad authority to control the production, distribution, and use of *all* potentially hazardous chemicals. It provides for testing of suspect chemicals before they become widely used and economically important. It emphasizes collection of information and freedom of access to research data so that the scientific community can note and assess potential problems.

Although we now have most of the basic legal tools for the task, it will not be accomplished easily. It will require coordination of research and regulation by many agencies under a dozen or more major federal laws, a program to fill information gaps and provide easy access to the data that exist, adequate funding, and intensive effort by trained people. In addition, we still have to cope with hazards left over from the past, not only those of PCB contamination but others as well.

- Workers at a Bayport, Texas, pesticide plant suffered partial paralysis, blurred vision, and other neurological disorders as a result of manufacturing exposure to leptophos, a pesticide produced solely for export and thus not controlled by EPA under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). The Occupational Safety and Health Administration is seeking civil penalties against the employer, Velsicol Chemical Company, which is charged with 44 safety violations at the Bayport plant.[2]
- Several hundred people in Michigan showed persistent ill effects 3 years after eating animal products contaminated with polybrominated biphenyls (PBB's). The meat, milk, and eggs of tens of thousands of farm animals were contaminated when PBB's intended for use as a flame retardant were accidentally mixed with animal feed in 1973. After the accident was discovered, more than 500 farms were quarantined and 30,000 cattle and countless other farm animals destroyed. In a study of the human health effects begun last fall, people exposed to the chemical reported swollen joints, abdominal pain, memory loss, muscular weakness, coordination difficulties, headaches, fatigue, and sleep disorders. Further research is underway to establish the relationship between exposure and these symptoms and to detect possible long-term effects, including cancer.[3]
- Also in Michigan, dioxins, which were found as contaminants of pentachlorophenol (PCP), a wood preservative used to treat lumber in farm structures, were blamed for a variety of illnesses in beef and dairy cattle. The animals are thought to ingest these compounds by licking the wood or by inhaling fumes from treated wood. Seven farms have been quarantined. Whether these chemicals have been passed on to humans is not yet known.[4]
- EPA reported to the Congress in January 1977 that ground water, the source of drinking water for one-half the U.S. population, has been contaminated locally in all parts of the nation and regionally in some heavily populated and industrialized areas. Contamination ranges from slight degradation to toxic concentrations of heavy metals, organic compounds, radioactive materials, and

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other hazardous substances. Most contamination comes from industrial waste water impoundments or land sites for solid waste disposal. Once ground water is contaminated, cleaning it up is rarely feasible, economically or technically.[5]

Problems like these, which are reported with increasing frequency, reveal severe weaknesses in the nation's programs for controlling hazardous substances. Failure to understand the pervasiveness of the problem, faulty testing for harmful effects (or none at all), poor access to existing information, failures of communication, disjointed legal and administrative jurisdictions, shortages of trained personnel and other resources, unresolved policy, and bureaucratic neglect have all contributed to these incidents.

Total human impact and *total* effect on the environment are the key factors in developing a rational approach to handling hazardous substances. For a pervasive chemical pollutant, all its environmental or biological pathways and interactions thoughout its life cycle, from extraction to production to consumer use to disposal, must be considered. A most important objective in improving our control programs, then, is coordination, rather than dealing with pollutants one by one as they appear in air, in water, on land, or in particular products.

Several agencies are developing mechanisms for program coordination. The President's Environmental Message of May 23 established prevention of harm from toxic substances as a high priority of his administration. The Message instructed CEQ to coordinate an interagency program to eliminate overlaps and fill gaps in the collection of data on chemicals and to coordinate federal research and regulatory activities affecting them. Following the President's directive, an Interagency Federal Toxic Substances Strategy Committee was formed, with 11 agencies and the Domestic Council participating. The four principal regulatory agencies—the Environmental Protection Agency, Consumer Product Safety Commission, Food and Drug Administration, and Occupational Safety and Health Administration—have formed an Interagency Regulatory Liaison Group to coordinate their common interests. The Department of Labor and Office of Management and Budget have announced a joint effort to eliminate duplication and fill gaps in regulating workplace hazards and to propose a system of incentives to supplement regulation.

The importance of dealing with toxic substances comprehensively and systematically has been highlighted in recent years by growing recognition of the environmental—and, in particular, chemical—contributions to cancer. Much of the information that follows relates to cancer-causing chemicals. It is important to note that carcinogenic chemicals are probably a small minority among the 3.5 million known chemicals. About 6,000 have been tested for carcinogenicity. Many were drugs and pesticides, which by definition are biologically active; less than 10 percent of these compounds have been found to be carcinogenic. In a random list of chemicals, a still lower percentage may be expected to exhibit carcinogenic activity. Of some 70,000 chemicals in commercial production, the *number* of carcinogens—in particular, the number to which there is widespread population exposure—may be quite small.[6] Nevertheless, because exposures are thought by many cancer researchers to have irreversible and additive or synergistic effects, widespread exposure to even low levels of individual chemicals is of grave concern.

An equally important point is that other adverse effects of chemicals must be investigated, for example, the climatic effects of fluorocarbon destruction of ozone in the stratosphere, damage to wildlife and fisheries from PCB's, and possible environmental causes of heart disease. (Heart disease is discussed in the environmental health section in Chapter 2.)

Toxic Substances Control Act

Enactment of the Toxic Substances Control Act[7] in October 1976 culminated nearly 6 years of executive and congressional deliberation. For the first time, the law empowers the federal government to control and even to stop production or use of chemical substances that may present an unreasonable risk of injury to health or environment. Manufacturers must give notice of plans to produce a new chemical or to market a significant new use for an old chemical. Producers may also be required to test selected chemicals or to report production quantities, uses, physical, chemical, and biological properties, and other information necessary for hazard assessment. In addition, the law requires recordkeeping and disclosure of significant health effects of dangerous chemicals.

The new public policy expressed in the law is that manufacturers of chemicals have an obligation to test product safety and that government has the authority to regulate potentially dangerous chemicals and to take immediate action on those that are an imminent hazard.

During the 6 years it took to pass the law, controversy centered on how to assess potentially harmful chemicals before marketing. Some advocated positive clearance by the Environmental Protection Agency before any new chemical or new use for a chemical could be marketed. The opposing argument was that such a massive clearance procedure would create an impossible regulatory burden and might impede progress and beneficial use of chemicals. Some in industry wanted no premarket notification at all; others proposed notification only for groups of chemicals that had been officially designated as hazardous.

The Act as passed takes a middle position, requiring manufacturers of all new chemicals and chemicals for new uses to give EPA 90 days' notice before manufacture begins. Any chemical not listed on an inventory of existing chemicals will be considered new. Positive clearance for each new chemical is not required before marketing, but EPA can stop the manufacture, sale, or use of any chemical that may present an unreasonable risk.[8]

Testing provisions of the Act are closely related. EPA may require manufacturers or processors to test any chemical, whether new or already in production, if it meets all these criteria:

- It may present an unreasonable risk to health or the environment, or there may be substantial exposure to the chemical
- Data for predicting health and environmental effects are inadequate
- Testing is necessary to develop the data.

Persistence, acute toxicity, and carcinogenic, mutagenic, teratogenic, behavioral, and synergistic effects are among the characteristics which the tests may evaluate.[9]

The testing requirements must be promulgated by regulation, with the usual opportunity for public comments and open hearings. EPA will be advised on what chemicals to select for testing from a federal interagency committee which may choose up to 50 chemicals from its list at any one time for priority testing. Within 1 year, EPA must either require testing of the chemicals on the priority list or publish the reasons for not doing so in the *Federal Register*.[10] With these detailed provisions, the law seeks to ensure prompt testing of the chemicals of greatest concern without placing too heavy a load on manufacturers to test everything at once.

The Act empowers EPA to regulate any aspect of a chemical's use which is likely to result in an unreasonable risk of serious or widespread injury to health or environment and to take immediate action against chemicals that present an imminent hazard. In addition, it requires specific action on polychlorinated biphenyls (PCB's), used in a myriad of products from ink solvents to hydraulic fluids to insulation for electrical transformers and capacitors, which had escaped comprehensive government control. EPA must issue labeling and disposal regulations for PCB's by July 1977, restrict their use to closed systems by January 1978, prohibit production by January 1979, and stop commercial distribution by the following July.[11]

Another important provision regards recordkeeping and information. EPA may now issue rules for selected chemicals, requiring that manufacturers and processors report the name of each chemical, its chemical identity, proposed uses, estimates of production levels, description of byproducts, adverse health and environmental data, and number of workers exposed. In this way, the use of a hazardous chemical throughout its life cycle would be known to EPA and subject to regulation. However, this reporting provision of the law contains a small business exemption, by which EPA rules could exclude small companies (such as Life Science Products, Inc., producer of Kepone, which had about 30 employees at any one time).

Industry is required to keep records of significant adverse health reactions apparently caused by any chemical for 30 years and of environmental damage for 5 years. EPA may request an industry to furnish existing health and safety studies on chemicals, and anyone with information that a chemical presents a substantial risk must notify EPA. Certain trade secrets and financial data are protected by the Act as confidential—but not health and safety information on chemicals. All such information is subject to full public disclosure.[12]

The ad hoc approach that has typified both public and private efforts to assemble information about chemical effects has contributed to many recent crises. Toxicity or environmental studies have generally been conducted only after a substance was marketed and ill effects observed. Moreover, integration of existing information on production levels, use patterns, contaminants, environmental transformations, human exposure, and other data useful in anticipating problems, has rarely been done. A major goal of the Toxic Substances Control Act is to expand, systematize, and exploit this and related information collected under other statutes to prevent hazardous environmental and human exposure.

Information

Assembling the Apparatus In recent months constructive efforts have been made to assemble new mechanisms for focusing, coordinating, and otherwise improving research on potential environmental hazards: EPA and CEQ have established an interagency group to coordinate chemicals-related information handling. In December 1976 the National Cancer Institute established the Clearinghouse on Environmental Carcinogens, composed of 30 nongovernment persons to provide advice and recommendations on choosing chemicals for testing, experimental design, and interpretation of results for its carcinogen bioassay program. In cooperation with the NCI, the National Institute of Occupational Safety and Health has undertaken a $10 million program of surveillance, industrywide studies, and laboratory research to identify carcinogens in the workplace.

The Food and Drug Administration has proposed new regulations for toxicological studies of food and drug products.[13] The Federal Food, Drug, and Cosmetic Act[14] and the Public Health Service Act[15] require manufacturers to demonstrate that their products meet safety and efficacy requirements. The tests are primarily intended to assess acute, subchronic, and chronic toxicity of the product, including reproductive or carcinogenic effects as well as degenerative disorders.

The FDA proposal was prompted by the disovery that required industry-sponsored tests often suffer serious deficiencies. Experiments were poorly conceived, carelessly executed, or inaccurately analyzed or reported. The proposal mentioned microscopic examinations of tissue slides conducted by "more than one pathologist each of whom came to different conclusions, yet only the conclusions favorable to the drug were submitted to the agency." In a toxicity study with rats, although gross changes of tissue appeared, management was not advised for 4 to 8 months. In another study, a drug was determined to be a tumorigen (i.e., it caused tumors); yet this information was not promptly given to the agency.[16]

The proposed regulations would set standards for organization and personnel, buildings and facilities, equipment, testing facilities, operations, quality assurance, protocols, study implementation and conduct, and recording and handling of data and reports. The Congress has approved an increase of $16.6 million for fiscal year 1977 and has directed the FDA to use the resources to ensure the quality and integrity of the data submitted to the agency in support of the products that it regulates.[17]

EPA has encountered similar deficiencies in toxicology test data submitted by pesticide manufacturers. In October 1976, EPA outlined a proposed plan for dealing with this matter, including selective auditing of laboratory records of pesticide toxicity testing and amending the regulations for development and submission of toxicological data.[18]

Chemical Inventory The Toxic Substances Control Act requires EPA to develop an inventory of existing chemical substances or mixtures, defined as those which have been manufactured or processed domestically for commercial purposes within the last 3 years. The inventory will identify new chemical substances that are subject to premarket notification and will provide baseline data for implementation of the Act. EPA published proposed inventory reporting regulations in March 1977 [19] and a revised proposal in August.[20] The proposed regulations would require certain manufacturers to report the identity of each chemical manufactured or imported and the site of production, to estimate the quantity manufactured or imported at each site, to indicate whether the chemical is manufactured and used only at one site, and to indicate whether the respondent is a manfacturer, processor, and/or importer of each such substance. In all, about 20,000 firms—mostly producers of chemicals and allied products representing about 95 percent of the nation's chemical production—will be required to report. Some 225,000 establishments that process chemical substances, such as fabricators of plastic and rubber products or firms that treat textiles, will not be covered. EPA has published a Candidate List of Chemical Substances to guide industry in reporting chemicals for the inventory list.[21]

Because the reporting regulations were substantially revised between March and August and reissued in draft form, publication of the inventory will not meet the statutory deadline of October 1977. EPA believes that the delay is warranted because of improvements in the draft regulations and the importance of the data base that will be generated. However, these initial reporting requirements will not produce a comprehensive data base on all chemical substances. Instead, they represent only the first step in a three-phase plan to meet the Act's requirements for reporting.

The first stage does not include collection of use data, although several federal agencies and environmental groups had urged EPA to include it in the initial reporting requirements. Use data for selected chemicals of particular concern to EPA, OSHA, the Consumer Product Safety Commission, and others will be collected in a second phase, which will also call for information on impurities, byproducts, worker exposure, and other matters. A third phase, to begin after the inventory is published in 1978, will require reporting for additional substances, selected in part on the basis of their production volumes as reported in phase one.

Regulation

Policy Developments Advances by regulatory agencies toward a more comprehensive and systematic approach to toxic substances problems were evident in the last year.

Pesticides Registration Because of the magnitude of the task and because many of the manufacturers' data to support the safety of their products are of questionable validity, EPA will not meet the October 1977 deadline[22] for reregistration and classification—that is, licensing the use of some 40-50,000 pesticide products as required by the 1975 Amendments to the Federal Environmental Pesticide Control Act.[23]

To expedite reregistration, the President directed EPA to work with the Congress on amending the Federal Insecticide, Fungicide, and Rodenticide Act of 1947[24] in order to refocus EPA regulations on the 1,850[25] basic active ingredients in pesticides rather than on the 40-50,000 individual brand name products. A faster, more efficient analysis of pesticide compounds would speed registration of desirable products and revocation of others.

Cancer Policy A literally vital task for federal agencies is to regulate human exposure to carcinogens. Decisions to regulate carcinogens often involve controversial policy judgments about how to deal with scientific and medical uncertainties. More often than not the issues are repetitively argued for each individual chemical as it becomes the subject of regulatory proceedings, but general principles for identifying, classifying, and regulating potential carcinogens have recently been proposed by several government agencies.

EPA has adopted interim cancer assessment procedures for use in all regulatory decisions—pesticide and nonpesticide—when cancer risk is a key factor.[26] The detailed guidelines and procedures require first an assessment of hazard, and then, after a detailed, independent economic analysis, a decision on what if any regulatory action to take. EPA is soliciting review and comments on its procedures from other federal agencies and outside groups.

The National Cancer Institute has recommended criteria for assessing a chemical as a potential carcinogen. The guidelines, finalized in June 1976, define a carcinogen and explain the kinds of evidence from animal experiments and epidemiological studies that would identify a potential carcinogen.[27]

The Occupational Safety and Health Administration proposed replacement of substance-by-substance rulemaking with a general approach.[28] The proposal would base regulatory action on three propositions: that although a "carcinogen" is difficult to define as a matter of science, it must be defined for purposes of regulatory activity, that a material confirmed as a carcinogen in a mammalian test species is to be treated as posing a carcinogenic risk to humans, and that because there is presently no means to determine a safe level of exposure to a carcinogen, permissible exposures will be as low as feasible. The degree of conclusiveness of data would be used to classify substances as confirmed, suspect, or neither, for which further analysis or new data may be needed, and to limit or eliminate exposure to the materials.

Occupational Health Standardsetting In May Secretary of Labor F. Ray Marshall announced new priorities for OSHA that will follow a "common sense approach" to health and safety and will avoid "nitpicking" regulations and enforcement. They are committed to prevention of occupational disease, more frequent inspection of high risk industries and less frequent inspection for less hazardous workplaces, "de minimis" notices for technical violations of standards with no direct bearing on safety and health, appointment of a special assistant for small businesses and expanding educational and consulting services available to them, and simplification of standards and elimination of those that are unnecesary.[29]

Hazardous Materials Labeling A first step toward preventing such incidents as the Kepone and leptophos tragedies is to provide information to all concerned—to processors, customers, workers, and others handling the material. The Occupational Safety and Health Administration is studying the 1975 recommendations of an advisory committee to require labeling of hazardous substances in the workplace. OSHA has requested public comment on whether a standard requiring such labeling should be developed and what the standard should specify to ensure that employees know the hazards to which they are exposed.[30]

Cosmetics Ingredients Labeling After a 2-year legal battle,[31] the U.S. Court of Appeals approved FDA efforts under the Federal Food, Drug, and Cosmetic Act [32] and the Fair Packaging and Labeling Act [33] to require ingredient labeling for cosmetics. For the first time the cosmetic industry is required to register products and formulations and to list the ingredients on each product label in decreasing order of volume, although to protect trade secrets, "fragrances" and "flavors" may be listed without stating their chemical composition.[34]

The new regulations will aid the consumer in selecting a product, but they do not require testing for product safety or including information concerning safety of a product on the label. Regulations on cosmetic safety are under consideration by FDA.

Regulatory Actions—Fluorocarbons Regulations proposed by the FDA, Consumer Product Safety Commission, and EPA in April are phasing out all nonessential aerosol uses of fluorocarbons -11 and -12.[35] Principally used as refrigerants and aerosol can propellants, the compounds are believed to deplete the stratospheric ozone layer that protects the earth's surface from a damaging spectrum of the sun's ultraviolet radiation. (For further discussion, see the air quality section in Chapter 2.)

If adopted, the regulations would prohibit the manufacture of fluorocarbon propellants after October 15, 1978, for nonessential use in foods, drugs, cosmetics, and household products or pesticides; prohibit use of existing supplies of fluorocarbons in the regulated nonessential products after December 15, 1978; and prohibit shipment in interstate commerce of all stocks containing the propellants after April 15, 1979. Products exempted include certain drugs, a mine safety warning device, and some flying insect sprays used on airplanes and in commercial food handling areas.

Present regulations require warning labels on all pesticides containing fluorocarbons and, as of October 1977, on food, drug, and cosmetic aerosols.[36] A similar requirement has been proposed for household products.[37] EPA has required all pesticides containing fluorocarbons to identify the ingredient prominently since April 15, 1977.[38]

Products affected by the proposed ban represent about 30 percent of the aerosol products on the market, down from 50 percent in 1974 when the ozone depletion theory was first postulated.[39] Because about one-half of all fluorocarbon emissions result from nonaerosol uses (chiefly refrigerants), a second stage of proposed rules is expected by mid-1978.

Hazardous Air Pollutants A "zero emission goal" was agreed upon by the Environmental Defense Fund and EPA as part of a settlement of EDF's suit against EPA[40] for its vinyl chloride emission standards.[41] Under authority of Section 112 of the Clean Air Act,[42] which requires EPA to promulgate national emission standards for hazardous air pollutants,* EPA promulgated a 10 parts per million limit on vinyl chloride emissions in 1976,[43] expecting a 95 percent reduction in average annual air concentration of the cancer-linked chemical around emitting facilities. EPA has proposed a standard of 5 parts per million within 3 years of promulgation.

EPA also proposed an amendment to regulations for asbestos,[44] to extend coverage for demolition and renovation[45] to all materials that are crumbly and contain more than 1 percent asbestos; current provisions apply only to insulation and fireproofing materials. Benzene was also added to the list of hazardous air pollutants (see the later discussion of benzene).[46]

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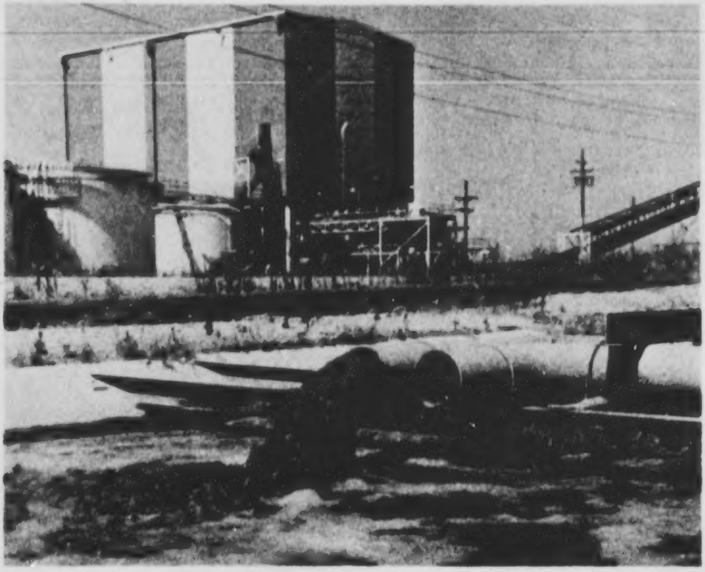
*Defined as any pollutant from a stationary source that may cause or contribute to mortality or irreversible or incapacitating illness. Other hazardous pollutants controlled under this section are beryllium, mercury, and asbestos.

Toxic Pollutant Effluent Standards The Federal Water Pollution Control Act [47] affords some protection against toxic pollution of the nation's water. Under Section 307(a) EPA is required to promulgate nationwide, industrywide effluent limits for toxic pollutants.* Standards were issued in January for aldrin/dieldrin, benzidine, DDT (and DDD, DDE), endrin, and toxaphene; [48] standards for PCB's were promulgated in February.[49] Standards for other toxic pollutants are scheduled to follow. The standards were issued under a consent agreement obtained from EPA by the Natural Resources Defense Council, the Environmental Defense Fund, and others, who charged that EPA had illegally failed to control any toxic effluent under Section 307.[50]



Flouride and phosphate wastes from a phosphate mining operation on the Pamlico River, North Carolina.

Drinking Water Standards Drinking water is specifically protected under the Safe Drinking Water Act of 1974.[51] EPA has set primary standards to protect human health from organic, inorganic, and microbiological contaminants and for turbidity in drinking water.[52] Standards for all four classes of contaminants are applicable to all public water systems, as defined by the Act, and are enforceable by EPA or the states which have accepted primary responsibility. The standards for nine inorganic chemicals and six organic pesticide contaminants are shown in Table 1.

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*Defined as those which, when assimilated either directly from the environment or indirectly through food chains, will cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions, or physical deformities in any organism or its offspring.

The primary regulations became effective in June 1977. Earlier regulations limiting radionuclides present in public drinking water systems were established in July 1976.[53]

EPA has not yet established primary drinking water standards for organic chemical contaminants. A suit brought by the Environmental Defense Fund against EPA [54] on this point is still in the courts. EDF is demanding that EPA set maximum contaminant levels for organic chemicals, a more stringent fluoride standard, and standards for sodium, sulfate, cadmium, and lead.[55]

EPA is considering standards for four major types of organic chemicals, all of which are suspected as possible health hazards: natural products of decomposition, products of chlorination and decomposed materials in raw water, organic chemicals from point sources (mainly from industry), and organic chemicals from nonpoint sources (mainly agricultural chemicals).[56] Because the real danger to human health from these organics is uncertain and because it is difficult to measure and remove organics from a water supply, EPA has been awaiting results of a 2-year study on drinking water contamination by the National Academy of Sciences.[57] The Agency will promulgate revised National Primary Drinking Water Regulations

Table 1

Primary Standards for Selected Inorganic Chemicals and Organic Pesticides

(milligrams per liter)

	Primary standard
Inorganic chemicals	
Arsenic	0.05
Barium	1.00
Cadmium	0.010
Chromium	0.05
Lead	0.05
Mercury	0.002
Nitrate (as N)	10.00
Selenium	0.01
Silver	0.05
Organic pesticides	
Chlorinated hydrocarbons	
Endrin	0.0002
Lindane	0.004
Methoxychlor	0.1
Toxaphene	0.005
Chlorophenoxys	
2,4-D	0.1
2,4,5-TP silvex	0.01

Source: 40 Fed. Reg. 59570–71 (1975).

based upon the report, which was mandated in the Safe Drinking Water Act of 1974.[58]

EPA has proposed secondary standards for drinking water [59] which deal with taste, odor, and color. Contaminants affecting esthetic qualities may have no effect on health or physical wellbeing, but they are unpleasant and may discourage use of a water supply. The standards are not enforceable by EPA but are intended only as guidelines for states.

Underground Drinking Water Supplies Approximately 100 million Americans depend upon underground sources of drinking water that is increasingly threatened by contamination (see the discussion at note 5). To protect underground drinking water supplies, EPA set standards in 1976 for state underground injection control programs. They provide for state-enforced minimum requirements for injecting fluids underground into many kinds of wells—industrial and municipal disposal wells, other storage wells, subsidence control wells, mining wells, brine disposal wells, and injection wells used in oil and gas recovery. Permits are required for any new underground injection. So long as existing wells do not endanger drinking water sources, they may be exempted from permit requirements for up to 5 years. But if they do endanger drinking water sources, they will have to be shut down while remedies are applied.[60]

Pesticides EPA has initated a "rebuttable presumption" against the pesticide ingredients listed in Table 2. It is a uniform screening method for all new or reissued pesticide registration applications and is designed to identify pesticides that may cause unreasonable adverse effects on the environment and to elicit extensive public comment and scientific review before EPA decides whether to allow continued use or to begin cancellation or suspension of a pesticide to remove it from the market. The only "rebuttable presumption" proceeding concluded so far concerned Kepone.

Table 2

Candidate Pesticides For Cancellation or Suspension

Pesticide	Date	Citation
Kepone	3/25/76	41 Fed. Reg. 12333 (1976)
Chloroform	4/6/76	41 Fed. Reg. 14588 (1976)
Chlorobenzilate	5/26/76	41 Fed. Reg. 21517 (1976)
Endrin	7/27/76	41 Fed. Reg. 31316 (1976)
Benzene hexachloride	10/19/76	41 Fed. Reg. 46024 (1976)
Compound 1080, 1081	12/1/76	41 Fed. Reg. 52792 (1976)
Lindane	2/17/77	42 Fed. Reg. 9816 (1977)
Amitraz	4/6/77	42 Fed. Reg. 18299 (1977)
Pronamide	5/20/77	42 Fed. Reg. 25906 (1977)
Toxaphene	5/25/77	42 Fed. Reg. 26860 (1977)
Diallate	5/31/77	42 Fed. Reg. 27669 (1977)

Cancellation Hearings For several years, EPA conducted cancellation hearings on Mirex, a suspected human carcinogen. The hearings closed in October 1976, when the Administrator accepted a plan proposed by the Mississippi Authority for Control of Fire Ants, the sole manufacturer of Mirex pesticides, for phaseout of production and use and cancellation of registrations in approximately 2 years.[61] The plan also provides for certain use restrictions during the phaseout period and for an accelerated program to develop alternatives for control of fire ants.

EPA has been conducting cancellation hearings for some time on the pesticides heptachlor and chlordane, which are also suspected human carcinogens. During the last year, extensive testimony was offered on the benefits and risks of use of these pesticides. A decision by the Administrator on these pesticides is expected in early 1978. The Administrator's Order suspending most uses of heptachlor and chlordane (i.e., banning most uses pending completion of cancellation proceedings) was upheld by a U.S. Circuit Court of Appeals in 1976.[62]

Industry has voluntarily canceled pesticides containing ingredients which are on the EPA list for consideration. Examples are OMPA,[63] Strobane,[64] Safrole,[65] and Aramite.[66] However, legal proceedings were recently initiated which question EPA's accepting voluntary cancellation.[67]

Kepone It is 2 years since the Virginia Health Department ordered the Life Science Products Company, a contractor of Allied Chemical Corporation in Hopewell, Virginia, to stop producing Kepone. But the disastrous effects of Kepone contamination of the James River and the surrounding Chesapeake Bay area continue. Kepone is a toxic, water insoluble, very persistent pesticide. Since then the two companies and the city of Hopewell have been involved in extensive litigation resulting from the widespread pollution of the James River and the physical harm done to former employees of Life Science.

In June 1976, Hopewell pleaded *nolo contendere* in a U.S. District Court to 10 out of 156 counts of pollution for its decision to allow Life Science to discharge Kepone-laden wastes into the municipal sewer system, disrupting the normal bacterial processes of sewage treatment and causing substantial pollution of the James River. The city was fined $10,000 and placed on probation for 5 years.[68]

Kepone is highly bioaccumulative and therefore can be lethal in surprisingly small concentrations—5 parts per trillion in the surrounding water may contaminate fish above FDA standards for human consumption.[69] Kepone poisoning in humans results in tremors, skin discoloration, blurred vision, loss of memory, coordination problems, and joint and chest pains. In laboratory animals it has been shown to cause cancer.[70]

Contamination of the James spread throughout the River and to much of the Chesapeake Bay area as well. In August 1976 EPA reported contamination of fin- and shellfish of up to 10 times allowable levels;[71] by February fish taken from the Bay were significantly below previously established limits. No action has been taken by FDA or the State of Virginia to close the Bay to fishing, but the ban in the River remains in effect.[72]

Based on recommendations from EPA, in March the FDA increased the Kepone action level from 0.1 to 0.3 parts per million for finfish but left the previous shellfish and crab levels at 0.3 parts per million and 0.4, respectively.[73] At these levels, however, the James River remains closed to fishing.

Allied Chemical is considering several methods of destroying the remaining Kepone products. Successful test-burning in a Toledo laboratory showing that Kepone can be reduced to a harmless mixture of water vapor, carbon dioxide, nitrogen, and common table salt may provide a method for the eventual elimination of most unused Kepone and of the highly contaminated factory residues.[74]

In August 1976 Allied also pleaded no contest to 940 criminal charges of illegally discharging Kepone into the James River.[75] The remaining 154 counts resulted in a $13.2 million fine, one of the largest penalties levied in a pollution trial. The fine was later reduced to $5 million by U.S. District Court Judge Robert Merhige when Allied donated $8 million to an independent environmental foundation in Virginia.[76] Two Life Science executives were convicted of conspiracy to violate federal antipollution statutes and were fined.[77]

Allied still faces $160 million in lawsuits from 31 former employees who were victims of Kepone poisoning.[78]

Benzene On the basis of a NIOSH study showing that workers exposed to benzene suffer leukemia at up to five times the expected rate, OSHA issued an emergency temporary standard in May.[79] The standard, which must be replaced by a permanent standard within 6 months,[80] would limit employee exposure to a concentration of 1 part per million and would require employee monitoring, protective equipment and clothing, and so on.

In production tonnage, only 11 other chemicals and 1 other hydrocarbon exceed benzene; approximately 11 billion pounds were produced in 1976 for use chiefly as an intermediate in the production of other organic chemicals and related products. Benzene is present in motor fuels (averaging less than 2 percent in gasoline) and is used extensively in chemical laboratories as a solvent and reactant.

EPA added benzene to the list of hazardous air pollutants in June.[81] Although further assessment is being carried out, EPA has tentatively concluded that emissions from some chemical manufacturing facilities, petroleum refineries, and coke ovens may need to be reduced. The Agency is exploring the Toxic Substances Control Act[82] and other authorities for use in addition to or instead of the Clean Air Act,[83] which requires proposal of emissions regulations within 6 months of listing a pollutant.

TRIS The Consumer Product Safety Commission took action in April 1977 [84] to ban children's clothing containing the flame-retardant TRIS (2,3-dibromopropyl phosphate) because laboratory tests showed that the compound poses a mutagenic and carcinogenic risk and that it can enter children's bodies by absorption through the skin or by their sucking treated fabric. The carcinogenicity of an impurity found in TRIS was first reported in 1973.[85]

Potential mutagenicity of TRIS was first reported in 1975.[86] When the Environmental Defense Fund petitioned the CPSC to require warning labels on TRIS-treated apparel in March 1976, the Commission initiated an evaluation. Preliminary analysis of NCI feeding studies with rats and mice, begun in 1974, established TRIS as a carcinogen in February 1977.[87]

Under the Federal Hazardous Substances Act,[88] which places the burden of commercial loss on the manufacturer of a hazardous product, the CPSC ordered manufacturers to repurchase treated garments.[89] Following a court ruling [90] that the action was arbitrary and capricious because it unjustly placed the entire burden of repurchase on the garment manufacturer, the CPSC then banned all TRIS-containing yarn, fiber, and fabric on May 5, distributing the loss among others in the production chain.[91]

The ban is no longer in effect. In August the U.S. Court of Appeals for the Fourth Circuit upheld another earlier District Court decision [92] vacating the ban on the grounds that CPSC erred procedurally in failing to hold public hearings to give affected parties an opportunity to present information and objections. The Commission is studying other regulatory options for taking TRIS-treated products off the market.

Acrylonitrile The use of acrylonitrile in plastic bottles intended for alcoholic and carbonated beverages was banned by the FDA in March 1977.[93] Interim results of a 2-year study by the Manufacturing Chemists Association showed that rats, given large doses of acrylonitrile monomer in drinking water, experienced significant losses in body weight, lesions in the central nervous system, and growths in the ear ducts and mammary regions. Shortly after FDA's action, preliminary results of an epidemiological study of workers at DuPont's textile fiber plant in Camden, South Carolina, indicated excess cancer incidence and mortality among workers exposed to the compound.[94]

Approximately 1.5 billion pounds of acrylonitrile are produced each year in the United States principally for use in the production of acrylic fibers and textiles; it is also used as a fumigant.

As a component of some plastic food containers, acrylonitrile is known to migrate into the food in small amounts. The FDA proposed further toxicity testing and proposed to reduce the allowable level of acrylonitrile monomer migrating from plastic containers into food.[95]

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The FDA is continuing to permit low levels of the chemical in foods such as margarine because people eat relatively small amounts of margarine. But because the per capita consumption of soft drinks in the United States is relatively high—110.1 liters per year in 1973[96]—the FDA has completely banned acrylonitrile in soft drink bottles.[97]

Lead in Paint The Lead-Based Paint Poisoning Prevention Act of 1971, as amended in 1973 and 1976,[98] is intended to help prevent lead poisoning among children. Among other things, it authorizes grants for detection and treatment of lead-based paint poisoning, provides for regulation of lead use in certain consumer items such as cooking utensils, and prohibits the use of lead-based paint in residential structures built, rehabilitated, or in any way assisted by the federal government. Lead-based paint is redefined in the 1976 Amendments as paint containing more than 0.06 percent lead unless the Consumer Product Safety Commission determines that another level is safe.[99] Reversing an earlier decision that 0.5 percent is safe, the Commission concluded that a safe level above 0.06 percent cannot be determined[100] and left the definition of "lead-based paint" as any paint with more than 0.06 percent lead, effective June 22, 1977. The sale of lead paint for most consumer uses and its use on any toys, furniture, and other household products will be prohibited after February 28, 1978, under regulations published in September 1977 by the Commission.[101]

PCB's in Food Citing new toxicity data on PCB's, indications of their carcinogenicity, the presence of PCB's in the environment and widespread occurrence of residues in fish, the FDA proposed in April 1977 to lower allowable levels of PCB's in food. Calling PCB's "unavoidable contaminants" that would be impossible to eliminate entirely, the FDA proposal would cut permissible levels in fish and shellfish to 2 parts per million from the present 5 parts per million and would significantly reduce levels for dairy and poultry products.

Other Events

Reserve Mining Since February 1972, the federal government, environmental groups, and states adjoining Lake Superior have been involved in a legal battle with Reserve Mining Company of Silver Bay, Minnesota, because of its daily discharge of 67,000 tons of asbestos-like taconite tailings into the Lake. Asbestos-like fibers have been found in the drinking water of Duluth and neighboring cities. Inhalation of asbestos is known to cause lung diseases, including cancer. The effects of ingestion, currently under study at the National Institute of Environmental Health Sciences, are as yet unknown.

A 3-judge Minnesota District Court recently overruled the Minnesota State Pollution Control Agency and the Department of Natural Resources and ordered the two state agencies to permit the company to build its proposed onland waste disposal facility at a site 7 miles from the Reserve plant.[102] Under a July 7, 1976, Federal District Court ruling, Reserve could not operate without an approved disposal site after July 6, 1977.[103] After extensive hearings and the preparation of a detailed environmental assessment, the state hearing officer and the Minnesota Department of Natural Resources maintained that the 7-mile-distant disposal site would cause pollution, impairing or destroying land, air, water, and other natural resources. They recommended an alternative site 20 miles from the plant. On appeal, the Minnesota Supreme Court directed the State to issue to Reserve all necessary permits (containing the necessary safeguards to public health) for the 7-mile site.[104] Subsequently the federal District Court extended the time during which Reserve could continue its discharges into Lake Superior to April 15, 1980, when the onland disposal facility at the site approved by the Minnesota Supreme Court is expected to be ready.[105]

OSHA Inspections In February 1977, the Supreme Court stayed a federal District Court injunction suspending OSHA inspections in Idaho on the grounds that inspections without warrants, as provided by the Occupational Safety and Health Act, violate the fourth amendment of the U.S. Constitution.[106] The Supreme Court order leaves the District Court's injunctions in effect only with respect to the particular company involved.

Carbon Tetrachloride Spills In an unprecedented action, EPA obtained a court order to halt production of carbon tetrachloride at the FMC Corporation plant in South Charleston, West Virginia.[107] The action followed at least 23 incidents in 2 years in which the chemical was spilled into the Kanawah River, with as much as 12,000 pounds discharged on some occasions. Carbon tetrachloride has shown carcinogenic, mutagenic, and other chronic toxic effects.

EPA invoked Section 504 of the Federal Water Pollution Control Act [108] and Section 1431 of the Safe Drinking Water Act[109] to obtain a 10-day temporary restraining order prohibiting spills, discharges, or leaks of carbon tetrachloride from the plant. This was the first time that either section had been applied. The FMC plant—the largest carbon tetrachloride producer in the Ohio River Basin—sent layoff notices to its employees, but the layoffs never took place because the parties signed a consent decree in the U.S. District Court for the Southern District of West Virginia on March 15. Under the agreement, production could not resume until containment facilities to limit discharge of carbon tetrachloride to 150 pounds per day per outfall were completed. The facilities were constructed within 3 weeks.

Drinking water was contaminated by the spills as far downstream as Evansville, Indiana. For 36 hours residents of Huntington, West Virginia, and other downstream communities were told to boil all water before use. Drinking water in Huntington contained 190 parts per billion carbon tetrachloride at that time; because the compound is carcinogenic, no safe level of exposure can be determined.

Evansville, Indiana, and Cincinnati, Ohio, have filed criminal suits against FMC for damage to municipal drinking water supplies.[110]

Table 3

Some Important Research Results Published in 1977

Carcinogens	In January 1977, NCI published an atlas of cancer death rates among nonwhites, a companion volume to a 1975 atlas showing regional patterns of death rates across ethnic lines; the atlases add support to the theory that environmental factors or elements of life style are significant determinants of cancer rates.[1]
PCB's	A possible association between occupational exposure to PCB's and cancer in humans was revealed in a preliminary analysis of medical records of employees exposed. Mobil Oil reported these findings from its Paulsboro, N.J., plant in a June 24, 1976, letter to NIOSH.[2]
Mirex	Possession of six species of Lake Ontario fish was banned in New York because of Mirex contamination in the lake. Mirex is chemically similar to Kepone and has been used as a pesticide and fire retardant; it is a suspected carcinogen. Mirex was distributed by the Hooker Chemical Company, Niagara Falls, among other companies.[3]
Beta-napthylamine	Two compounds that are not known to cause cancer, a widely used rubber oxidant and byproduct of alpha-naphthylamine manufacture, are metabolized to the known human carcinogen B-naphthylamine, NIOSH announced in December 1976. The Institute noted that this discovery emphasizes a relatively neglected problem, the potential metabolism of materials believed to be relatively innocuous into carcinogens.[4]
Olefin	Union Carbide announced that residues from its olefin operations (in which naphtha and liquefied petroleum gas are cracked to make ethylene, propylene, and other olefins) cause skin cancer in mice.[5]
2–Nitropropane	A solvent widely used in industrial coatings and printing inks caused liver cancer in rats in a study sponsored by NIOSH.[6]
Nitrosamines	Nitrosamines, which are among the most potent carcinogens known, are found in commercial cutting fluids and certain herbicides, according to a September 1976 announcement by the National Science Foundation [7] EPA has been petitioned to suspend registration of the pesticide products that contain these compounds and is soliciting additional information.[8]
Benzene, chromium (VI), and 4, 4'-methylenebis (2-chloroaniline) (MOCA)	NIOSH called for OSHA to establish emergency temporary standards for benzene, chromium (VI), and 4, 4'-methylenebis (2-chloroaniline) (MOCA) as a result of new evidence of their potential carcinogenicity in humans.[9]

Nitrogen compounds	Scientists studying compounds other than fluorocarbons that might also reduce the stratospheric ozone layer have tentatively concluded that increases in atmospheric levels of oxides of nitrogen, particularly N_2O, from increased application of fixed nitrogen in agriculture, may be important. Although knowledge of the nitrogen cycle is fragmentary, reductions of the ozone layer of a few percent early in the next century and of 10 percent by its end are postulated. Emissions of N_2O from coal combustion is also suggested as a potential contribution to this problem.[10]
Lead	A study conducted in Kellogg, Idaho, revealed that children between the ages of 1 and 9 living near the town's lead smelter have unusually high concentrations of lead in their blood, in fact the highest reported in any U.S. community. The lead is thought to be absorbed into blood from inhaled airborne particles. Thus far, no clinical lead poisoning has been reported, but the increased blood lead levels have resulted in anemia, raised erythrocyte protoporphyrin levels, and subtle neurological defects.[11]

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[1] T. J. Mason et al., *Atlas of Cancer Mortality Among U.S. Nonwhites* (Washington, D.C.: Government Printing Office. 1976), DHEW Pub. No. (NIH) 76–1204.

[2] A.K. Babin et al., "Melanoma after Exposure to PCB's," *N. Eng. J. Med.* 295(8):450 (1976).

[3] New York Department of Environmental Conservation, press release, September 14, 1976.

[4] National Institute for Occupational Safety and Health, *Current Intelligence Bulletin: Beta Naphthylamine* (December 17, 1976).

[5] Union Carbide Corporation, "NIOSH Informed by Union Carbide of Possible Carcinogen," news release, August 1976, in a letter from C.V. Dernehl, Associate Corporate Medical Officer, to J.F. Finklea, Director, NIOSH, August 20, 1976.

[6] National Institute for Occupational Safety and Health, *Current Intelligence Bulletin: 2-Nitropropane* (April 25, 1977).

[7] National Institute for Occupational Safety and Health, *Current Intelligence Bulletin: Nitrosamines in Cutting Fluids* (October 6, 1976).

[8] 42 Fed. Reg. 10886 (1977).

[9] John Finklea, Director, National Institute for Occupational Safety and Health, memorandum to Morton Corn, Assistant Secretary of Labor, Occupational Safety and Health Administration, October 29, 1976.

[10] P.J. Crutzen and D.H. Enhalt, "Effects of Nitrogen Fertilizers and Combustion on the Stratospheric Ozone Layer," *Ambio* 6:112–17 (1977).

[11] P.L. Landrigan et al., "Increased Lead Absorption with Anemia and Slowed Nerve Condition in Children near a Lead Smelter," *Journal of Pediatrics* 89:1904–1910 (1977).

AIR

After 3 long years of effort in the Congress, the 1977 Amendments to the Clean Air Act [111] were signed into law by the President in August 1977. The Amendments, which reflected hundreds of hours of hearings, conferences, markup sessions, and floor debates, did not strike out in bold, new directions. Primarily they slightly modified existing programs. The Amendments were passed in time to allow the automobile manufacturers to market their 1978 models.

The most controversial issue was how much to relax automobile emissions requirements. Other major issues involved preventing significant deterioration in areas where the air is presently cleaner than national standards and providing for continued air quality improvement and economic growth in areas that have not attained the air quality standards. The Amendments also contain important provisions on defining and enforcing compliance.

Automobile Standards

The deadline for the required reduction in automobile emissions, originally set for 1975 and subsequently postponed to 1978, was further extended to 1980 for unburned hydrocarbons and to 1981 for carbon monoxide by the 1977 Amendments.[112] In addition, the required nitrogen oxide (NO_x) control has been slightly modified. Table 4 compares the new and old schedules. Under the 1977 Amendments the NO_x emission standard has been changed from 0.4 to 1.0 grams per mile. The Administrator of EPA can also delay the 1981 carbon monoxide and nitrogen oxide limits for up to 2 years, taking into account such factors as cost, driveability, fuel economy, and impacts on health, if he determines that the required tehnology is not available.

The Amendments include special certification for cars to be used at high altitudes,[113] a waiver for fuel-saving diesel engines that would allow NO_x emissions to remain at 1.5 grams per mile up to 1983, a waiver of NO_x emissions controls for up to 4 years for other innova-

Table 4

Automobile Emission Control Schedules

	1976	1977	1978	1979	1980	1981	1982
1970 Clean Air Act							
HC	1.5	0.41					→
CO	15.0	3.4					→
NO_x	3.1	2.0	0.4				→
As of July 1, 1977							
HC	1.5		→0.41				→
CO	15		→3.4				→
NO_x	3.1	2.0	0.4				
1977 Amendments							
HC	1.5				→0.41		
CO	15				→7.0	3.4	→
NO_x	3.1	2.0				1.0	→

tive technologies, and a special 2-year waiver for small U.S. manufacturing companies allowing NO_x emissions to remain at 2.0 grams per mile to 1983.[114]

For the most part these standards will force the use of three-way catalysts. The limited information available so far indicates that catalyst-equipped cars can be quite reliable *if* they are kept well tuned, but that their emission rates do deteriorate with "normal" maintenance. Consumer or mechanic tampering with the carburetor seems to be the major cause of cars in use failing to meet the standards. Preliminary data from EPA surveys show that 68 percent of the in-use cars which they tested could meet all three emission standards that apply to them if the carburetors were retuned to manufacturers' specifications and missing or disconnected parts of the emission control system were replaced or repaired.[115] This percentage is approximately the same as that allowed in assembly line testing of new cars.

EPA studies have also shown that the problem of excess sulfates from catalyst-equipped cars seems less serious than earlier estimates had suggested.[116] These estimates indicated that cars equipped with a catalyst and an air pump could emit levels of sulfuric acid aerosol which would be of public health concern. EPA has measured sulfate concentrations along the Los Angeles Freeway for the last 2 years to determine the actual seriousness of the sulfuric aerosols problem. The measurements indicated that the problem was less serious than feared. The 1977 Amendments require additional studies on this issue and also require an extension of the National Academy of Sciences studies analyzing the health impacts of automobile-related pollutants.

In order to ensure that in-use vehicles meet the emission control requirements, the Amendments include provisions to encourage the testing of automobiles as they are sold.[117] In the past compliance has been determined almost solely by prototype vehicles tested prior to assembly line production. The Act's provisions discouraging tampering with emission control systems were also extended to independent repair and service businesses and selling, leasing, trading, and fleet operations.[118] Such provisions previously applied only to manufacturers and dealers. There was also a weakening amendment which reduced the duration of required warranties for emission control systems, although particular devices such as catalytic converters and thermal reactors will continue to have warranties which run for 5 years or 50,000 miles.[119]

The Amendments also include modifications to emission control requirements for trucks, motorcycles, and other vehicles [120] and provisions to limit the use of gasoline additives.[121]

Prevention of Significant Deterioration

The issue of how much to protect air quality in regions that are already cleaner than the ambient air quality standards was also the subject of extended debate. This is a key issue in many western states where clean air is highly valued but where there is also strong pressure to develop the region's coal resources—development that might be curtailed if the air quality standards were too strict. Under the Amendments, clean air areas are to be divided into three classes: Class I, in which very little air quality deterioration would be allowed; Class II, in which only moderate air quality deterioration would be allowed; and Class III, where more significant deterioration would be allowed (as long as ambient standards were not exceeded).[122] The Congress designated large National Parks and Wilderness Areas as Class I areas.* All other lands are Class II unless redesignated either Class I or Class III by the State Governor.

Under certain circumstances, however, a facility may receive a variance from the sulfur dioxide limits allowed for Class I areas.[123] The extent of the variance depends upon the topography surrounding the facility. A Governor may grant a variance only if the applicant demonstrates that the proposed source cannot be built without the variance and that the additional pollution will not adversely affect air quality-related values such as visibility or health. Public hearings are required. For National Parks or Wildernesses (or other federai land) designated as Class I areas, the federal land manager—the Secretary of Interior, for example—must also concur. If there is a conflict between the Governor and the federal land manager, the decision is referred to the President.

The Amendments require EPA to issue regulations to protect visibility in Class I areas within 2 years.[124] Little is known about the impact of air pollution on visibility, but it has been established that under certain circumstances emissions from a single powerplant can affect visibility as much as 150 miles away. It appears that the main factors affecting visibility are fine particulate emissions as well as aerosols formed from nitrogen oxide and sulfur dioxide emissions. Current ambient air quality standards do not explicitly relate to this problem although some control measures do reduce such emissions. The question still remains whether these controls are adequate.

Nonattainment Areas

Under the 1970 Amendments no provision was made to allow construction of new sources or substantial expansion of old sources in air quality control regions that exceeded ambient air quality standards after 1975. The lack of such a provision could effectively have stopped all economic growth in many urban areas. EPA had previously proposed an "emission offset policy" to deal with the problem.[125] In slightly modified form, this policy was adopted in the 1977 Amendments.

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*Mandatory Class I areas are: International Parks, National Wilderness Areas which exceed 5,000 acres, National Memorial Parks which exceed 5,000 acres, and National Parks which exceed 6,000 acres.

States must submit revised implementation plans by 1979 which will provide for the attainment of ambient air quality standards by 1982 in most cases.[126] For areas heavily affected by automobile emissions, if "all available measures" will not attain ambient standards, states must submit a revised plan which will impose all the requirements to attain the ambient standards by 1987. In effect, then, the attainment deadlines have been extended from 1977 to 1982 for most pollutants and probably to 1987 for automobile-related pollutants. The 1987 extension allows areas to benefit from nearly all the pollution reduction to be expected from improved automobile emission controls before the deadline.

But while extending these deadlines, the Congress also imposed special requirements for new facilities to be located in areas that exceed ambient standards. In such areas, new sources will be allowed only if they attain "the lowest achievable emission rates" and if other sources in the state under the same ownership or control are in compliance with relevant emission control provisions. In addition, the state must reduce emissions in the nonattainment area each year and must make sufficient progress in the early years of its revised plan to ensure that the ambient standard will be attained by the 1982 or 1987 deadline. For automobile-related pollutants, the revised plans must include vehicle inspection and maintenance programs, and states which fail to submit or implement approved plan requirements may lose Department of Transportation highway funds. However, the Congress limited EPA authority to require review of "indirect sources" (sources which do not emit substantial amounts of pollutants themselves but may indirectly cause air pollution problems because they attract large numbers of automobiles, e.g., a highway or a sports center) by restricting it to projects receiving federal funds.[127]

The new Amendments should allow continued growth in all urban regions without sacrificing the air quality goals established by the 1970 Amendments.

Compliance and Enforcement

In the many provisions related to defining or enforcing compliance, the Clean Air Act Amendments aim to make enforcement fairer and more effective while avoiding excessive impacts on energy use or the economy. There are provisions allowing variances for technological innovations,[128] requiring economic impact statements with all new regulations,[129] requiring evaluation of employment losses resulting from regulations issued under the Act, and mandating a study of potential employee dislocation resulting from the Act.[130] The Amendments also allow for delayed compliance orders under certain circumstances and extend compliance deadlines for facilities converting to coal [131] and for smelters.[132] They also allow temporary relief from the regulations when there is an energy or economic emergency.[133] All the provisions demonstrate a desire to avoid highly adverse impacts.

This Gary, Indiana, steel plant is representative of many plants beginning to achieve significant reductions of emissions in compliance with the Clean Air Act.

At the same time, many of the provisions strengthen EPA's ability to enforce air pollution control regulations. Perhaps most important among them is an attempt to define an economic penalty that would eliminate any cost advantage of being out of compliance.[134] Modeled after a plan developed and implemented in Connecticut, this provision incorporates for the first time economic penalties which can be set administratively.[135] Under the plan the penalty imposed on a firm that is not in compliance with requirements is set to equal the cost savings of being out of compliance. Thus there is no economic incentive or competitive advantage to be experienced by flouting the law. However, the plan contained in the 1977 Amendments does not have many of the advantages of flexible application which were the intent of the original design.

Other sections of the Amendments provide a more rigorous definition of new source performance standards requiring performance at least as good as that which could be obtained by using the "best technological system of continuous emission reduction." [136] It also provides for resolving problems of interstate pollution [137] and for more effective state enforcement against federal facilities.[138]

Other Issues

EPA is required to determine the public health risk of the following pollutants: radioactive pollutants, cadmium, arsenic, and polycyclic organic matter.[139] In the event that the Administrator does find any to be a threat to health, EPA must then establish appropriate ambient or emission standards. By including radioactive pollutants, the Amendments could transfer a large part of the responsibility for controlling radioactive emissions from the Nuclear Regulatory Commission to EPA and to the states through the regulatory process.

The Amendments' requirements for a number of further studies seem to indicate a desire by the Congress to stimulate EPA's expanding its regulatory authority beyond the problems posed by the five health-related criteria pollutants (total suspended particulates, sulfur oxides, nitrogen dioxide, carbon monoxide, and oxidants) for which ambient standards were specifically required in the 1970 Act.

On the other hand, the Congress also recognized the need for periodic review of the law's requirements and of the adequacy of standards; the 1977 Amendments require standards to be reviewed every 5 years after 1980[140] and establish a National Commission on Air Quality similar to that which reviewed the Federal Water Pollution Control Act under its 1972 Amendments.[141]

WATER

The Federal Water Pollution Control Act Amendments of 1972 started a vigorous program of pollution abatement, with the goal of eliminating all discharges of pollutants into the nation's navigable waters by 1985.[142] This year marks the fifth anniversary of the program and the end of its first phase, which called for adoption of "best practicable technology" for keeping pollutants out of water bodies by July 1, 1977. (For municipal sewage treatment plants, the requirement is for secondary treatment by the 1977 deadline.[143]) Although this goal has not been fully met, progress has continued both in implementing the current program and in defining future needs. Anticipation of new directions to be established by the new Administration and of "midcourse corrections" being considered in this session of the Congress have imposed a degree of restraint upon making far-reaching decisions and undertaking new projects.

Municipal Grants Program

In the first phase of the cleanup program mandated by the FWPCA, $18 billion of federal grants was authorized to help municipalities develop effective pollution controls for waste water. Annual obligations have increased from $1.6 billion in fiscal year 1973 to $7.2 billion in fiscal year 1977. The increases are shown in Table 5. By August 1977, EPA had awarded 11,608 grants totaling $14.3 billion and 2,345 projects had been completed. Of the 10,307 active projects, 3,475 are under or awaiting construction, and the others are at the planning or design stages.[144]

Issues In the past the issue of most concern in the construction grants program was the slow rate at which EPA approved projects and obligated funds. It is no longer a problem because EPA's present rate of obligation exceeds the rate at which future funds are likely to be authorized, but several other issues are. There are increasing

POLLUTED
WATER
NO SWIMMING
OR WADING
NATIONAL PARK SERVICE

Rock Creek in Washington, D.C., is one of many water bodies where swimming is prohibited.

delays in beginning construction once a grant is awarded; some states are running out of federal funds while others are having trouble spending their share; there is continued concern whether the money is being spent in the most cost effective manner—particularly when used for tertiary treatment facilities and capital intensive facilities in small communities.

Project Construction Delays Litigation, environmental problems, administrative tieups, contractor and bidding problems, and siting difficulties are responsible for most delays between approval of a grant and beginning of construction (Figure 1), but for some projects municipal funding to supplement the 75 percent federal grants is apparently lacking.[145] Last year the Congress authorized EPA to

Table 5

Municipal Waste Water Treatment Construction Grants, 1957–77

(billion dollars)

Year	Authorization	Appropriations	Obligations	Outlays
1957	50	50	38	1
1958	50	45	47	17
1959	50	47	46	36
1960	50	46	48	40
1961	50	46	45	44
1962	80	80	64	42
1963	90	90	92	52
1964	100	90	85	66
1965	100	90	84	70
1966	150	121	118	81
1967	150	150	131	84
1968	450	203	191	122
1969	700	214	201	135
1970	1,000	800	424	176
1971	1,250	1,000	1,152	478
1972	2,000	2,000	860	413
1973	[1] 7,000	[2] 3,900	2,989	684
1974	6,000	3,000	2,608	1,553
1975	7,000	4,000	4,131	1,938
1976 [3]	0	9,000	4,852	3,347
1977	7,700	1,980	[4] 7,168	3,546
Total	30,020		[5] 25,376	12,928

[1] Includes $2 billion for reimbursement to municipalities for prior construction.
[2] Includes $1.9 billion for reimbursement to municipalities for prior construction.
[3] Includes transition quarter.
[4] Includes $0.5 billion for reimbursement to municipalities for prior construction.
[5] Includes $2.3 billion for reimbursement to municipalities for prior construction.

Source: U.S. Environmental Protection Agency, Office of Planning and Management, "Activities of the Grants Assistance Programs," September 1977.

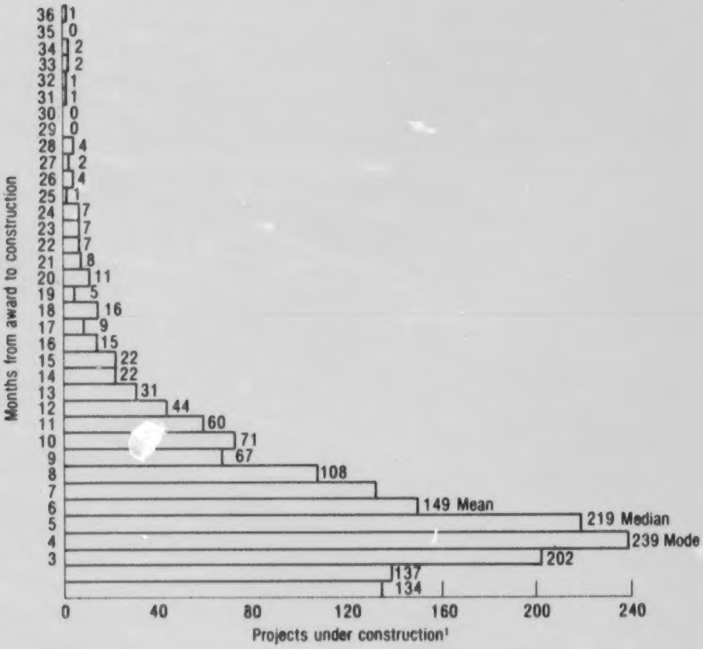
guarantee bonds to finance the nonfederal share of constructing sewage treatment plants when a local government cannot secure private financing at a reasonable interest rate.[146]

Funding The worst problem facing the municipal grants program this year was the threat that a number of states might run out of federal funds. Continuity—the long-term assurance of funding—is essential. It takes 2 to 3 years to move a project through planning and design into the construction phase. Interrupted federal funding disrupts state and local government planning and budgets. Although the municipal grants program is federally funded and supervised, each state has its own program and proceeds at its own pace. Some states have moved ahead rapidly while others have been impeded by litigation or by administrative or legislative obstacles.

To assist states in danger of running out of money, shown in Table 6, $1 billion was added in the fiscal year 1977 supplemental appropriation [147] and an additional $480 million in the Public Works Employ-

Figure 1

P.L. 92-500 Project Construction Delays



[1] Under construction determined by the issuance to initial contractor of a notice to proceed under a contract or, if a notice to proceed was not required, the execution of the initial contract awarded on the project.

Source: U.S. Environmental Protection Agency, Office of Planning and Management, Office of Resources Management, *Activities of the Grants Assistance Programs* (Washington, D.C., 1977), p. 27.

ment Appropriation Act of 1976.[148] But these were only temporary measures. The Administration requested an additional $3.5 billion for fiscal year 1977 and $4.5 billion for each of the subsequent 9 years.

Needs Survey of 1976 Long-range funding estimates for the municipal grants program rely heavily on EPA's biennial survey of state and local governments to determine funds needed to meet the 1983 goals of the Act. In 1976 EPA completed its third "Needs Survey," which estimated a required $96 billion investment for sewers and treatment plants and another $54 billion to control pollution from storm sewers (see Table 7).[149]

The 1976 figures are less than one-third those of the 1974 Needs Survey, largely because of substantially lower estimates for storm water pollution control. The 1976 projection for collecting and

Table 6

States and Territories in Danger of Running Out of Federal Funds for Municipal Treatment Systems, May 31, 1977

	Allocations (millions)	Unobligated (millions)	Percent unobligated	Fiscal year 1977 supplemental appropriation
0–15 percent unobligated				
Maine	153.1	.045	0	5.5
New Hampshire	153.8	15.2	10	6.7
New Jersey	1,300.7	80.9	6	47.6
Virginia	496.2	26.9	5	22.0
Minnesota	337.9	46.9	14	15.1
Texas	508.9	60.4	12	43.0
Iowa	199.0	19.4	10	11.0
Hawaii	112.4	7.3	6	7.0
Nevada	65.5	5.9	9	3.3
Oregon	155.5	16.2	10	8.3
15–35 percent unobligated				
Rhode Island	90.9	15.8	17	4.0
Massachusetts	573.9	188.5	33	27.7
Nebraska	81.7	13.6	17	6.1
Montana	31.2	5.1	16	3.3
North Dakota	17.1	4.9	29	3.3
South Dakota	22.0	5.4	25	3.3
Utah	53.9	14.0	26	5.1
Wyoming	12.7	3.9	30	3.3
District of Columbia	146.3	25.3	17	4.0
Maryland	572.0	184.2	32	37.9
Pennsylvania	992.8	173.6	17	46.7
Alabama	119.3	29.0	24	10.9
Florida	705.9	122.3	17	35.8
Kentucky	201.6	64.3	32	15.0
Mississippi	93.5	27.1	29	7.5
Illinois	1,136.5	246.8	22	52.2
Ohio	979.3	280.9	29	55.5
Wisconsin	297.5	90.8	31	19.9
Arkansas	99.3	33.5	34	10.8
New Mexico	41.7	11.9	28	3.3
Missouri	321.9	74.5	23	19.8
Colorado	104.5	35.8	34	8.0
California	1,894.1	560.3	30	82.4
Guam	14.4	4.4	31	1.0
Alaska	55.9	8.8	16	4.8
Idaho	43.1	9.6	22	4.1
Washington	225.1	58.7	26	15.4
35 percent and over unobligated				
Vermont	45.4	16.0	35	3.3
Connecticut	308.7	131.9	43	12.2
Puerto Rico	175.8	87.8	50	8.9
American Samoa	2.3	1.5	65	0.3
Pacific Islands	9.8	6.3	65	2.0
Georgia	269.9	94.6	35	19.9

Table 6—Continued

	Allocations (millions)	Unobligated (millions)	Percent unobligated	Fiscal year 1977 supplemental appropriation
35 percent and over unobligated—continued				
Virgin Islands	15.4	7.4	48	0.5
North Carolina	258.9	100.2	39	20.7
Kansas	126.6	54.6	43	12.2
Arizona	65.8	26.0	39	6.3
New York	2,089.6	767.8	37	105.3
Delaware	111.0	42.9	39	4.0
West Virginia	156.4	72.4	46	21.6
South Carolina	184.6	79.5	43	13.1
Tennessee	228.2	95.8	42	14.9
Indiana	483.6	226.7	47	21.7
Michigan	1,213.7	587.8	48	46.9
Louisiana	171.3	69.9	41	12.5
Oklahoma	151.8	62.7	41	13.5

Sources: U.S. Environmental Protection Agency, Municipal Construction Division, Office of Water Program Operations, *Clean Water Fact Sheet*, June 13 and August 12, 1977.

treating municipal sewage and controlling pollution from combined sewer overflows was 57 percent below that of the 1974 estimate of $151 billion. The costs of controlling storm water pollution are 84 percent lower than the 1974 estimate. Reasons cited for the differences are that the methodology was improved, more information was available from plans and permits, some projects included in the 1974 survey are no longer eligible for grants, some had been counted twice, and $8 billion in projects was approved between the 1974 and 1976 surveys.[150]

Cost Effectiveness of Projects As the federal funds are obligated and the Needs Surveys analyzed, there is increasing concern about what is being built under the municipal grants program. Unfortunately, EPA does not maintain an easily accessible record of funding by type of facility. Thus we have no clear idea of how the money is being spent except for the imperfect signs provided by the information EPA does collect and by analyses of sample projects.

The Council expressed concern 3 years ago about money spent on sewers serving vacant land and the tendency to build oversized facilities.[151] EPA has attempted to develop procedures discouraging such environmentally and economically undesirable practices.[152] But it is possible that the states funded many such projects to avoid losing their share of funds by failing to obligate them before the September 30, 1977, deadline.

Questions have also arisen about advanced (beyond secondary treatment) waste treatment facilities. Such facilities can provide important benefits in removing nutrients from the sewage where the

Table 7

Comparison of 1976 and 1974 Needs Surveys

(billion 1976 dollars)

	1976 Needs Survey	1974 Needs Survey	Percent difference
Needs category			
I Secondary treatment	13.0	17.81	−27
II More stringent treatment	21.3	22.24	−4
IIIA Infiltration/inflow	3.0	7.42	−59
IIIB Replacement and/or rehabilitation	5.5	10.25	−46
IVA New collector sewers	17.0	24.58	−31
IVB New interceptor sewers	17.9	25.27	−29
V Combined sewer overflows	18.3	43.51	−58
Total I–V	95.9	151.08	−37
VI Control of stormwater	54.1	329.	−84
Total I–VI	150.0	480.08	−69

Source: Environmental Protection Agency, *Cost Estimates for Construction of Publicly-Owned Wastewater Treatment Facilities—1976 Needs Survey: Report to Congress* (Washington, D.C., February 10, 1977), EPA-430/9-76-010 (MCD-48A), p. 7.

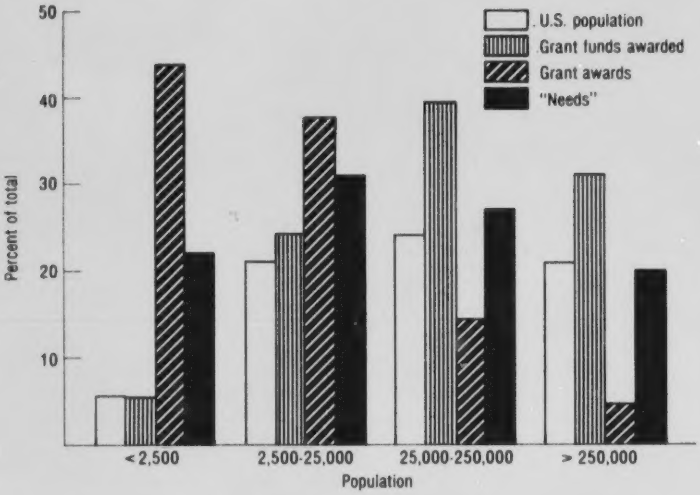
effluent enters watercourses suffering eutrophication, but they do not remove substantially more of the standard pollutants such as BOD, suspended solids, and fecal coliform than a properly operating secondary treatment plant. They are expensive in both investment and operating costs and in energy consumption.

A General Accounting Office study of 26 advanced treatment plants found that most were built without a thorough analysis of whether they were needed or, in fact, what their impact on water quality would be.[153] Yet substantial numbers are now under construction, and more than 9,000 municipal treatment systems are expected to include more than secondary treatment. The total cost of these facilities is expected to exceed $21 billion.[154] If these facilities are not needed, the money could be used elsewhere to solve serious pollution problems.

Finally, there is concern about the number and types of facilities being construeted in small communities. Figure 2 summarizes the most recent information on "Needs" and grants by community size. Communities with fewer than 2,500 people are shown as needing almost one-fourth the projected expenditures for sewers and treatment plants. The cost per person served, based on projected population, is $580, compared to $185 per person for communities with more than 25,000 people. Of the total grants so far, 43.6 percent of the number of grants but only 5.4 percent of the money has gone to small communities.[155] Most of those awards may have been for planning which could lead to larger expenditures in the future.

Figure 2

Municipal Grants and Needs, by Community Size



Source: U.S. Department of Commerce, *Statistical Abstract of the United States: 1973* (Washington, D.C.: Government Printing Office, 1973), p. 18; U.S. Environmental Protection Agency, Municipal Construction Division, Office of Water Program Operations, *Clean Water Fact Sheet*, April 1977, p. 4; U.S. Environmental Protection Agency, Municipal Construction Division, Office of Waste and Hazardous Substances, unpublished analysis of EPA's 1976 Needs Survey.

Although "small community" can refer to a small part of a much larger community (in New York City there are "small communities" with their own treatment systems), many of the smaller communities are rural. Proposed central treatment systems will replace individual septic tanks. Whether the charge will actually reduce pollution and improve water quality is not clear. Even if 20 percent of the septic tanks are failing and are discharging raw sewage, a central treatment plant usually removes only 80 percent of the pollutants and disposes of the effluent in a single concentrated stream. In general, there is less danger of bacteria and other disease agents from a treatment plant than from septic tanks, but the impact on dissolved oxygen may be more serious.

EPA's new guidelines expand the range of alternative systems for small communities, and the Agency is holding seminars around the country to inform people about the guidelines and the special problems faced by small rural communities.[156]

Operation and Maintenance Operation and maintenance of sewage treatment plants are the key to success of the water pollution control program. Without good O&M, facilities will not operate at design efficiency, and the result will be polluted waters and wasted money.

Many local governments have neither trained manpower nor financial resources for proper O&M of sewage treatment facilities.[157] GAO recently found treatment plants deficient in trained staff, budget, controls over industrial wastes, laboratory testing controls, plant design, and equipment, and there were infiltration and inflow problems.[158]

In November 1976 EPA announced that it will provide technical assistance to plants with O&M problems, including some onsite training, expert operational assistance, instruction in advanced laboratory procedures, maintenance management, and records management; it will also provide guidance on preparing a plan of operation.[159]

Compliance

All municipal and industrial point source dischargers of waste water effluent are required to obtain a permit issued through the National Pollutant Discharge Elimination System (NPDES) Permit Program, which is administered by EPA or, alternatively, by the states. The permit limits concentrations and amounts of effluents which may be discharged and includes a schedule for reducing pollution to meet these limitations. Twenty-eight states have been approved for participation in the NPDES program; elsewhere EPA issues the permits.

As of September 30, 1976, 64,877 municipal and nonmunicipal dischargers had been identified as subject to the NPDES program,[160] and 52,723 permits had been issued, as shown in Table 8.

Table 8

Status of Permits Issued under the National Pollutant Discharge Elimination System (NPDES), September 30, 1976

Discharger	Permits issued [1]			Total identified dischargers	Percent of total
	6/75	1/76	9/30/76		
Industrial and agricultural	21,639	26,958	33,364	42,892	77.79
Major	2,797	4,213	4,625	4,407	104.95
Minor	18,842	22,745	28,739	38,485	74.68
Municipal	16,664	16,845	19,359	21,985	88.06
Major	2,714	4,375	4,641	4,605	100.78
Minor	13,950	12,470	14,718	17,380	84.68
Federal facilities	1,988	2,062			
Major		226			
Minor		1,836			
Total	40,291	45,865	52,723	64,877	81.27

[1] In some cases the number of permits issued exceeds the number of sources identified. The primary reason is that "permits issued" included permits reissued. Another reason is that certain large plants with several outfall pipes are reported as a single source although more than one permit may have been issued.

Source: Environmental Protection Agency, *EPA Enforcement: A Progress Report 1976, Air, Noise, Pesticides, Water* (Washington, D.C.: Government Printing Office, 1977), p. 54.

Based on self-monitoring reports reviewed by EPA and the states, 8,300 sampling inspections, 27,200 nonsampling inspections, and other enforcement activities, EPA estimated that only 14 percent of major industrial dischargers did not achieve the "best practicable technology" (BPT) statutory deadline of July 1, 1977.[161]

A study by the Water Pollution Control Federation indicates that only 33 percent of municipal waste water facilities would comply with secondary treatment requirements by the July 1, 1977, deadline.[162] Using data generated by EPA's 1976 Needs Survey, the Federation estimated that only 4,244 existing facilities, serving 112 million people, would be in compliance. Table 9 and Figure 3 show compliance by region.

Table 9

Compliance Rates for Facilities and Flow of Existing Plants Meeting Secondary Treatment Requirements by July 1, 1977

Region	Facilities	Facilities in compliance		Flow		
		Number	Percent	Total sewered [1]	Receiving treatment [1]	Percent treated
I	393	224	57.0	3,865	2,085	54.0
II	764	292	38.2	12,935	4,360	33.7
III	1,338	732	54.7	11,710	6,730	57.5
IV	2,120	630	29.7	13,170	5,500	41.8
V	2,907	847	29.1	26,385	4,850	18.4
VI	1,812	356	19.6	7,620	2,410	31.6
VII	1,748	326	18.6	4,860	1,085	22.3
VIII	715	338	47.3	3,075	1,760	57.2
IX	742	363	48.9	12,655	5,600	44.2
X	267	136	50.9	3,315	1,650	49.8
Total	12,806	4,244	33.1	106,190	36,030	33.9

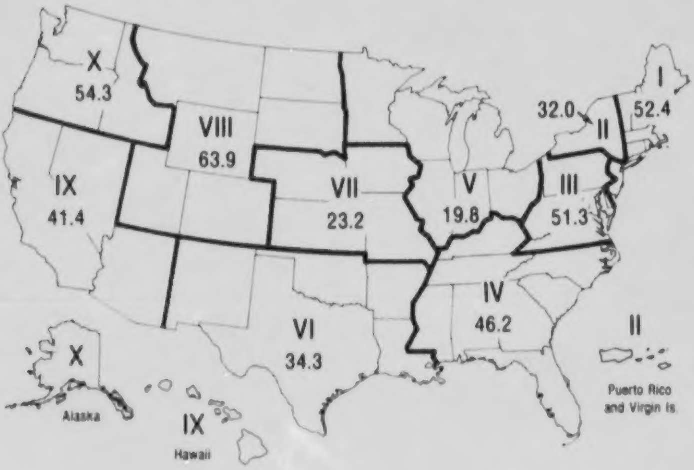
[1] Thousand cubic meters per day.

Source: *Water Pollution Control Federation Journal* 49:360 (1977), based on the 1976 Needs Survey Statewide Municipal Compliance Schedule for July 1, 1977 requirements.

Delays in achieving the statutory deadlines may be beyond the control of the dischargers. For such cases, EPA has begun to issue "enforcement compliance schedule" letters stating the agency's intention to refrain from enforcing the July 1, 1977, deadline established in the laws and embodied in the NPDES permit issued to the source, so long as the discharger complies with the delayed abatement schedule and other terms set forth in the letter. The legality of this approach has yet to be tested.[163]

Figure 3

Estimated Percent of Sewered Population with Secondary Treatment, July 1, 1977



Source: *Water Pollution Control Federation Journal* 49:361 (1977), based on EPA's 1976 Needs Survey.

Industry

Effluent Limitation Guidelines In February, the Supreme Court supported EPA's authority and approach to industrial pollution control when it ruled in the case of *DuPont* v. *Train*.[164] Eight chemical firms had questioned EPA authority to set precise nationally uniform numerical pollution limits by industrial category rather than setting individual limits for each plant through the permit process. The Court ruled that EPA is to take individual plant variations into account when existing sources are involved but appeared satisfied that EPA's variance clause satisfied this need. A decision supporting the plaintiffs would have significantly disrupted EPA's progress in establishing pollution control requirements for all industrial dischargers.

Interim and final effluent standards were issued for five new industries during the past year, as shown in Table 10.

Pretreatment Regulations A continuing problem involves the discharge of industrial effluents into municipal treatment systems. Potentially such effluents can have serious impacts on the ability of systems to operate properly, on options for sludge disposal, and on water quality.[165] Some states have begun to enforce standards, either locally or state developed, requiring industrial dischargers to treat effluents before discharge into municipal waste treatment plants, and

Table 10

Interim and Final Industry Effluent Standards

Industrial category	Group I		
	Phase I		
	Subcategories	Date proposed	Date promulgated
Cooling water intake structures	1	12/13/73	4/26/76
Dairy products processing	11	1/14/74	5/28/74
Grain mills	6	10/11/73	3/20/74
Canned and preserved fruits and vegetables	5	11/30/73	3/21/74
Canned and preserved seafood processing	14	1/3/74	6/26/74
Sugar processing (beet and cane)	2	10/29/73	3/20/74
Textile industry	7	2/5/74	7/5/74
Beet sugar	1	8/22/73	1/31/74
Cement manufacturing	3	9/7/73	2/20/74
Feedlots	2	7/7/73	2/14/74
Electroplating	1	12/7/73	3/28/74
Organic chemicals	3	12/7/73	4/25/74
Inorganic chemicals	22	10/11/73	3/12/74
Plastics and synthetics	13	11/9/73	4/4/74
Soap and detergent manufacturing	19	12/14/73	4/12/74
Fertilizer manufacturing	5	12/26/73	4/8/74
Petroleum refining	5	12/14/73	5/9/74
Iron and steel manufacturing	12	2/19/74	6/28/74
Nonferrous metals manufacturing	3	12/4/73	4/8/74
Phosphate manufacturing	3	10/7/73	2/20/74
Steam electric power generating	4	3/4/74	10/8/74
Ferroalloy manufacturing	3	10/18/73	2/22/74
Leather tanning and finishing	6	4/8/73	4/9/74
Fiberglass	1	8/22/73	1/22/74
Glass manufacturing	6	9/7/73	2/14/74
Asbestos manufacturing	7	10/5/73	2/26/74
Rubber processing	4	10/11/73	2/21/74
Timber products processing	8	12/20/73	4/18/74
Pulp, paper, and paperboard	5	2/6/74	5/29/74
Builders paper and roofing felt	1	12/17/73	5/9/74
Meat products and rendering	4	10/30/73	2/28/74
Poultry	5	4/24/75	4/26/76
	Phase II		
Dairy products processing			
Grain mills	4	9/17/74	1/3/75
Canned and preserved fruits and vegetables	51	[1] 10/21/75	4/16/76
Canned and preserved seafood processing	19	[1] 1/30/75	12/1/75
Sugar process (cane sugar)	5	[1] 2/27/75	
Textile industry			
Cement manufacturing			
Feedlots			
Electroplating	3	[1] 4/25/75	
Organic chemicals	4	[1] 1/5/76	
Inorganic chemicals	41	[1] 5/22/75	
Plastics and synthetics	11	9/20/74	1/23/75
Soap and detergent manufacturing			
Fertilizer manufacturing	2	10/7/74	1/14/75
Petroleum refining			
Iron and steel manufacturing	23	[1] 3/29/76	
Nonferrous metals manufacturing	5	[1] 2/27/75	12/15/76
Phosphate manufacturing	3	[1] 1/27/75	
Steam electric power generating			
Ferroalloy manufacturing	5	[1] 2/24/75	

See footnote at end of table.

Table 10—Continued

Industrial category	Group I		
		Phase II	
	Subcategories	Date proposed	Date promulgated
Leather tanning and finishing			
Fiberglass			
Glass manufacturing	6	8/21/74	1/16/75
Asbestos manufacturing	4	8/29/74	1/9/75
Rubber processing	7	8/23/74	1/10/75
Timber products processing	7	[1] 8/26/74	1/16/75
Pulp, paper, and paperboard	10	2/19/76	1/6/77
Builders paper and roofing felt			
Meat products and rendering	6	8/28/74	1/3/75
Poultry	5	4/24/75	
	Group II		
Dairy products processing			
Grain mills			
Canned and preserved fruits and vegetables			
Canned and preserved seafood processing			
Sugar processing (beet and cane)			
Textile industry			
Beet sugar			
Cement manufacturing			
Feedlots			
Electroplating			
Organic chemicals			
Inorganic chemicals			
Plastics and synthetics			
Soap and detergent manufacturing			
Fertilizer manufacturing			
Petroleum refining			
Iron and steel manufacturing			
Nonferrous metals manufacturing			
Phosphate manufacturing			
Steam electric power generating			
Ferroalloy manufacturing			
Leather tanning and finishing			
Fiberglass			
Glass manufacturing			
Asbestos manufacturing			
Rubber processing			
Timber products processing (furniture)	4	11/14/74	6/2/75
Pulp, paper, and paperboard			
Builders paper and roofing felt			
Meat products and rendering			
Poultry			
Machinery and mechanical products	261		
Coal mining	4	[1] 10/17/75	
Petroleum and gas extraction	4	[1] 9/15/75	
Mineral mining and processing	17	[1] 10/16/75	
Water supply	15		
Miscellaneous foods and beverages processing	12		
Pharmaceutical industry	5		
Ore mining and dressing	7	[1] 11/6/75	
Transportation industries	7		
Fish hatcheries and farms	3		
Paving and roofing materials (tars and asphalt)	4	1/10/75	7/24/75

See footnote at end of table.

Table 10—Continued

Industrial category	Group II		
	Subcategories	Date proposed	Date promulgated
Auto and other laundries	9		
Converted paper products	1		
Paint formulation	1	[1] 2/26/75	7/28/75
Ink formulation	1	[1] 2/26/75	7/28/75
Printing	17		
Steam supply	2		
Pretreatment for oil and grease			
Clay and gypsum	12		
Concrete products	2		
Shore receptor and bulk terminals	4		
Gum and wood chemicals industries	6	[1] 5/18/76	
Pesticides and agricultural chemicals	5	[1] 11/1/76	
Adhesive and sealants industries	6		
Explosives industries	4	[1] 3/9/76	
Carbon black industries	4	[1] 5/18/76	
Photographic point source category	6	[1] 7/14/76	
Hospitals	4	[1] 5/6/76	
Battery manufacturing	13		
Edible oils	2		
Plastic processing	5		
Foundries	9		
Coil coating	3		
Porcelain enamel	5		
Aluminum and aluminum alloy products	6		
Copper and copper alloy products	6		
Electronics	18		
Shipbuilding	1		

[1] Interim final guidelines.

Source: Information supplied by Environmental Protection Agency, Office of Water and Hazardous Substances.

in February EPA reissued proposed national pretreatment guidelines.[166] A major question raised by the EPA proposals is whether EPA or the states would have major responsibility for enforcing the limitations or whether this responsibility would be left to the municipality.

Toxic Pollutant Effluent Standards In the summer of 1976 EPA proposed stringent toxic pollutant effluent standards for six substances under Section 307(a) of the FWPCA: aldrin/dieldrin, DDT, endrin, toxaphene, benzidine, and PCB's. Following lengthy formal rulemaking hearings, final standards were promulgated during January and February 1977.[167]

Over the next several years, the control of toxic pollutants will be achieved primarily through effluent limitation guidelines, new source performance standards, and pretreatment standards following EPA strategy which integrates other sections of the Act as well. This strategy is set forth in the settlement agreement in *NRDC* v. *Train*.[168]

Section 208 Areawide Planning

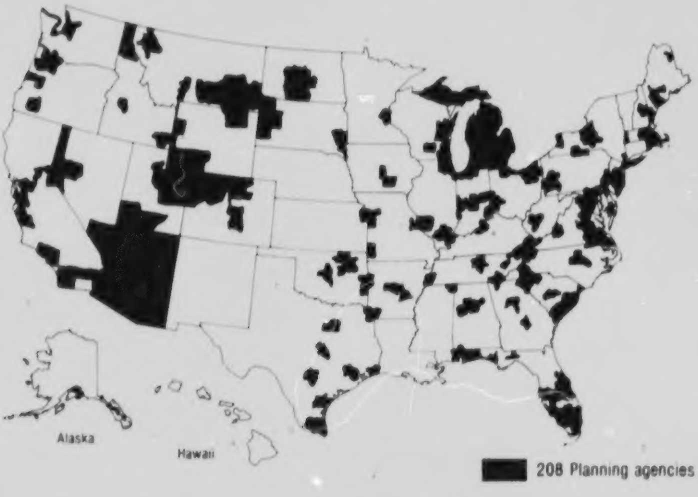
Section 208 of the FWPCA provides federal grants for the development of areawide waste treatment management plans by state-designated agencies. Twenty-seven new Section 208 areawide planning agencies were funded during fiscal year 1976, for a total of 176, shown in Figure 4. All 50 states have been funded for programs covering areas not included in the areawide plans. Due to delays in implementing Section 208 and subsequent funding problems, the program has not yet accomplished all that was intended. But there are some positive signs. This year the Governor of Colorado submitted the first plan to EPA for formal approval.[169]

The 208 planning process is still evolving. In updating its policy on the relationship of water and air quality management, EPA announced availability of 208 funds for activities related to the purposes of the water management plan.[170] EPA has also signed memoranda of agreement with DOT, HUD, and other agencies to pursue, among other objectives, the establishment of single agencies responsible for areawide 208, air quality, transportation, and other infrastructure planning.[171]

The most important responsibility given to the local 208 agencies is to develop means to control nonpoint source pollution. Because

Figure 4

Location of Section 208 Planning Agencies, July 1976



Source: U.S. Environmental Protection Agency, Water Planning Division, Program Management Branch, *Water Quality Management Directory* (Washington, D.C., 1976), p. viii.

of the delay in implementing Section 208, progress in controlling nonpoint sources has been meager. An EPA ad hoc study group recommended that EPA continue to rely on the 208 program for nonpoint source control, enlist the aid of other federal agencies with expertise in nonpoint source control, shift from national to regional guidelines and standards for nonpoint source control, and increase regional financial resources.[172]

Meanwhile, EPA has become more aggressive in controlling pollution from storm water runoff, agricultural return flows, and other nonpoint sources and prepared a draft memorandum to the Regional Administrators for use in 208 planning for controlling nonpoint sources. The agency has also proposed regulations to control point sources such as storm sewers through a combination of general 5-year permits and abatement measures designed by 208 planning agencies.[173] The regulations cover public and private storm sewer drains, pipes and other outlets, and irrigation return flow ditches, channels, and culverts.

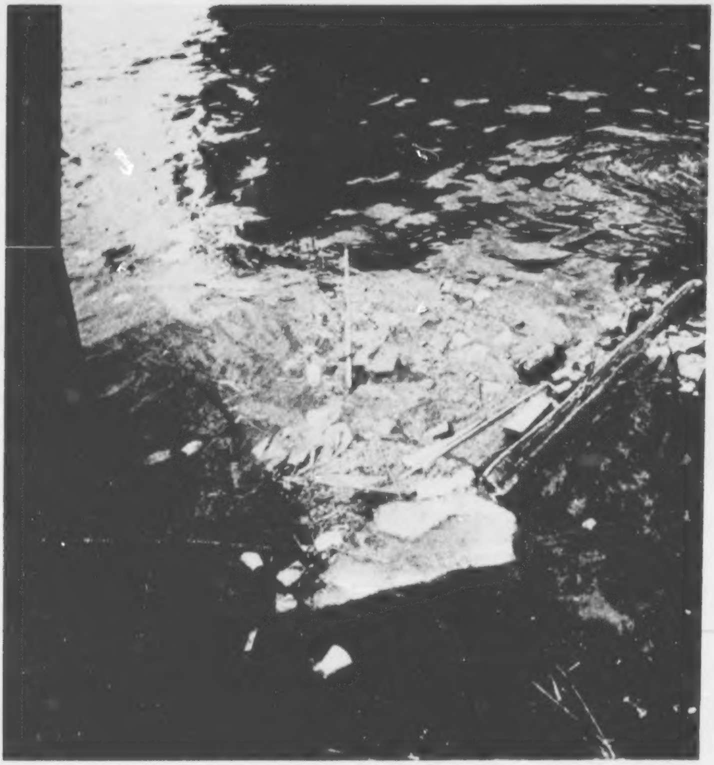
A variety of control techniques for nonpoint sources is being developed, but their effectiveness in any specific situation is sometimes difficult to determine. Costs vary as well. The cost of fertilizer controls for croplands, for example, is minimal, but soil stabilization at construction sites can run as high as $12,000 per acre.[174]

Under the 1976 Small Business Act Amendments, federal assistance will be available to farmers trying to control agricultural pollution.[175] Farmers can apply for Small Business Administration loans to help control water pollution from agricultural activities.

Ocean Dumping

In January 1977, EPA ruled that all sludge and industrial waste dumping in the Atlantic Ocean must end by December 31, 1981. In conjunction with New York and New Jersey, EPA has begun a number of pilot programs for sludge disposal, using alternatives such as pyrolysis and composting.

Although the phaseout of ocean dumping is supposed to coincide with the development of disposal alternatives funded through the municipal grants program, Camden, New Jersey, found itself in a precarious situation last winter when EPA refused to renew its dumping permit which expired in November. The New Jersey Department of Environmental Protection also blocked Camden from disposing of its sludge in state landfills. Finding that the city had only 2 days' capacity remaining at its disposal site and that an unacceptable health risk would result if immediate action were not taken, the U.S. District Court for the District of New Jersey ordered EPA to issue an emergency 90-day permit extension to allow the city to dump its sewage sludge in the Atlantic Ocean.[176] The permit was extended until December 1977 by which time the city planned to be composting its sludge for field applications.



By 1977 communities must be using the "best practicable" technology and by 1983 the "best available" control methods. Strict control over refuse dumped from vessels is needed.

A General Accounting Office study issued in January found that some disposal alternatives being implemented by EPA may not be environmentally sound and may actually result in more harm to the environment than ocean dumping.[177] The report cited landfill problems of seepage and submergence during periods of high rainfall and the possibility that EPA does not know the impacts of transferring municipal and industrial wastes to other parts of the environment—to air, ground water, and land. The GAO suggested ocean disposal of some wastes if it can be shown that unreasonable degradation of the marine environment will not result.

Administration Proposals

In June 1977 the Administration proposed amendments to the Federal Water Pollution Control Act. They focused on the efficiency of the municipal grants program, enforcement tools, and the specific issues of controlling toxic pollutants and protecting wetlands.

Although, in 1976, the National Commission on Water Quality recommended a delay of up to 10 years in the current requirement that all sources adopt the best available technology for pollution control by 1983, the Administration did not support any extension in the deadlines. However, EPA has committed itself to reviewing and, if necessary, revising the best available technology guidelines to ensure that the cost of removing additional nontoxic pollutants is consistent with the benefits that would be expected to result.[178]

The amendments suggested for the municipal grants program included an incentive for water conservation and elimination of separate storm sewers, collector sewers, and sewer rehabilitation from eligibility for federal funding. Further, federal funding of reserve capacity in municipal treatment systems was limited to projected needs for users in the service area—10 years from the time construction begins for treatment works and 20 years for sewers and associated facilities. Long-term funding was linked to progress in controlling nonpoint source pollution, imposing effective pretreatment requirements in municipal systems, and other requirements listed in Section 208.

In order to promote water conservation, the Administration proposed that the federal share of a grant would be reduced from 75 to 70 percent of construction costs unless a municipality undertook to reduce water use in the system by at least 15 percent during the dry season and unless the designed capacity, size, or other features of the facility reflected the reduced waste water flow. Such savings are estimated to be easily available in most municipal systems and to result in a cost savings of at least 5 percent.[179]

Elimination of funding for separate storm water systems, collector sewers, and sewer replacement and rehabilitation should substantially lower the potential obligations of the federal government (the total of these three categories in the 1976 Needs Survey was $76.6 billion).[180] The elimination of collector sewers could seriously affect some rural communities, but the Administration has pledged to increase the funding available for these sewers through the Farmers Home Administration. The elimination of storm water control and sewer rehabilitation, on the other hand, will most seriously affect the older cities, which will have to use their community development block grant funds or their own revenues to deal with these problems.

The Administration also fulfilled its promise to request $45 billion for the municipal grants program over the next 10 years, with the proviso that the states must implement certain other portions of the Act in order to receive these funds after November 1978. Availability of funds would be contingent upon a state's taking adequate steps to control nonpoint sources of pollution, adopt adequate pretreatment requirements for industries discharging into municipal sewers, and develop comprehensive plans for the efficient and effective construction, operation, maintenance of municipal waste treatment systems. By 1982 all the 208 plans would have to be completed and action taken to implement them.[181]

Several proposals dealt with improved enforcement tools, clarifying the authority of EPA and the states to issue enforcement orders and to simplify the process of judicial review of guidelines, permits, and orders. The most significant proposal, however, was to allow the Administrator or the state to impose "noncompliance fees" on sources which are not in compliance with the conditions of their discharge permits. These fees would be tied to the cost savings experienced by the discharger as a result of being out of compliance. This proposal begins to bridge the gap between the regulatory approach embodied in the existing law and the effluent fee approach often proposed as an alternative.

Two issues addressed specifically in the Administration's proposals are the control of toxic pollutants and the protection of wetlands. The strategy in dealing with toxic pollutants is to depend primarily on the 1983 best available technology requirements to control discharges from the most significant industrial categories. However, amendments were also proposed to Section 307(a) of the Act, which directly addresses the problem of toxic pollutants, to correct some of the procedural problems which had interfered with EPA's implementing this authority in the past. The proposed improvements to this section would allow it to be used to respond quickly to newly identified problems and other toxic pollutant problems that are not dealt with adequately under the best available technology strategy.

Under the Administration's proposals on wetlands, states would be authorized to issue and enforce permits for the dredging or filling of wetlands just as they do to control pollution discharges. Some activities—dryland farming, for example—would be exempted from the requirement to obtain discharge permits; the permitting agencies could issue general permits to whole categories of activities, and the time to be taken for government review of a permit application would be limited.

SOLID WASTES

Hazardous Wastes

The Resource Conservation and Recovery Act (RCRA),[182] passed in the closing days of the 94th Congress, promotes resource recovery and conservation and mandates government control of hazardous waste from its generation to ultimate disposal. The federal government is charged with primary responsibility for this unprecedented program.

The Problem The problem of hazardous waste has grown to serious proportions in recent years for several reasons: as a nation, we are increasing our consumption of all materials, including hazardous materials; several toxic substances have been banned from use, and existing stocks are "thrown away"; and as air and water pollution controls increase, hazardous waste residues result.

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Hazardous materials include toxic chemicals, pesticides, acids, caustics, flammables, and explosives. The sources are many—farms, government installations (primarily the Energy Research and Development Administration and the Department of Defense), hospitals, and laboratories, but by far the greatest quantities originate in numerous industries.

The Kepone tragedy of 1976, in which employees of the Hopewell, Virginia, pesticide firm suffered severe nerve damage and James River fisheries were devastated, is not unique. Recently, more than 25,000 tons of toxic sludge, the residue of pesticides dumped into Louisville's sewer system, were responsible for closing the treatment plant, sending employees home ill, and diverting raw sewage into the Ohio River where the untreated sewage seriously threatened the health of communities downstream. Removal, handling, and disposal of the contaminated sludge were apparently beyond the capabilities of local and state officials. Other less publicized cases of injury to health and environment have also been traced to poorly managed hazardous wastes.

A recent EPA study of damages resulting from improper hazardous waste disposal found that ground water contamination is the most common damage reported, followed by surface water contamination[183] (see Table 11). Although the data summarized in the table are not nationally representative, they do indicate the nature of the damages.

Estimates of the quantity of hazardous waste generated in the United States are at best approximate. Table 12 shows estimates

Table 11

Hazardous Waste Disposal Damage[1]

Problem	Disposal method and number of cases				
	Surface impoundments 89	Landfills, dumps 99	Other land disposal[2] 203	Storage of wastes 15	Smeltings, slag, mine tailings 15
Ground water pollution (259)	57	64	117	10	11
Surface water pollution (170)	42	49	71		8
Air pollution (17)	3	5	9		
Fires, explosions (14)		11	3		
Direct contact poisoning (52)	1	6	40	5	
Wells affected (140)	32	28	74	4	2

[1] Data derived from 421 case studies of land disposal and industrial wastes. Figures total more than 421 because several damage incidents involved more than one damage mechanism.

[2] Includes haphazard disposal on vacant properties, on farmlands, and spray irrigation.

Source: Environmental Protection Agency, Office of Water Supply/Office of Solid Waste Management Programs, *Waste Disposal Practices and Their Effects on Ground Water, Report to Congress*, January 1977.

and projections of hazardous wastes from 14 important waste-generating industries. Hazardous wastes as defined in these estimates are those requiring land disposal; discharges in waste water are not counted. For some industries—batteries in particular—the 1974 estimates seriously understate the real problem because at that time controls on discharges of pollutants, as required by the Federal Water Pollution Control Act,[184] were not yet in effect. After waste water treatment is adopted, hazardous substances may remain in residues which require land disposal and are therefore counted. A more serious shortcoming of the estimates is that hazardous wastes from mining are not included. The quantities of possibly hazardous wastes—radioactive wastes, for example, from uranium and phosphate mining or toxic metal or acid wastes from coal mining—may be very large. EPA has not yet defined how much of these wastes are hazardous. Finally, although industry is the major source of hazardous wastes, there are additional significant wastes from the sources previously noted (hospitals, laboratories, etc.). For these reasons, the figures in Table 12 should be taken as illustrative, not comprehensive.

The technology for environmentally sound treatment, storage, and disposal of hazardous waste is generally available. It is far from fully used because there has been no economic incentive or, until passage of RCRA, little legal compulsion to do so. Good hazardous waste management can cost 10 to 40 times as much as the unsatis-

Table 12

Potentially Hazardous Wastes from Selected Industries[1]

(million metric tons per year wet weight)

Industry	Pre-P.L. 92–500 1974	Projected	
		1977[2]	1983[3]
Batteries	0.010	0.164	0.209
Inorganic chemicals	3.400	3.900	4.800
Organic chemicals, pesticides, and explosives	6.860	11.666	12.666
Electroplating	5.276	4.053	5.260
Paint and allied products	0.096	0.110	0.145
Petroleum refining	1.756	1.841	1.888
Pharmaceuticals	0.065	0.074	0.108
Primary metals, smelting and refining	8.267	8.973	10.440
Textiles dyeing and finishing	1.770	1.870	0.716
Leather tanning	0.146	0.143	0.214
Special machinery	0.163	0.153	0.209
Electronic components	0.035	0.078	0.108
Rubber and plastics	0.785	0.944	1.204
Waste oil re-refining	0.057	0.074	0.144

[1] Hazardous wastes are here defined as wastes which require land disposal.
[2] Assuming best practicable treatment of waste water from industrial sources.
[3] Assuming best available treatment of waste water from industrial sources.

Source: Information supplied by the Environmental Protection Agency, Office of Solid Waste.

factory methods in current use—dumping, ponding, and burial without adequate safeguards.[185] According to a recent study, the hazard-

Table 13

Hazardous Waste Management Industries' Estimated Process Capacity, 1974

(thousands of gallons per 24-hour day)

Region	Chemical treatment	Incineration	Secure landfill	Deep well injection	Resource recovery
Region I					
Maine					5
Massachusetts	46	4	4		4
Subtotal	46				9
Region II					
New York	45	108	190		17
New Jersey	26	45	49		40
Subtotal	71	153	239		57
Region III					
Maryland	30	10	5		5
Virginia		15	5		
Pennsylvania	235	10	5		10
Subtotal	265	35	15		15
Region IV					
Kentucky		15	23		
North Carolina		20			
Tennessee		9			
Georgia	20		23		
Subtotal	20	44	46		
Region V					
Michigan	470	80	20		25
Illinois	400	75	35		30
Minnesota		16			
Ohio	485	150	120	100	45
Wisconsin	25		5		20
Indiana	150	40	50		195
Subtotal	1,530	361	230	100	315
Region VI					
Oklahoma	5		10	20	
Texas	65	60	125	775	230
Subtotal	70	60	135	795	230
Region VII					
Missouri	250	5	66		50
Subtotal	250	5	66		50
Region IX					
California	57	14	639		400
Subtotal	57	14	639		400
Region X					
Washington	28		125		405
Idaho			200		
Subtotal	28		325		405
Total	2,337	676	1,714	895	1,481

Source: E. Lazar, R. Testani, and A. Giles, U.S. Environmental Protection Agency, "The Potential for National Health and Environmental Damages from Industrial Residue Disposal," presented at the National Conference on Disposal of Residues on Land, September 15, 1976.

ous waste industry was comprised of 95 firms with 110 sites in 1975. Average utilization of capacity was 53 percent, ranging from 30 to 80 percent, depending on the process and the region of the country. The study estimated that there was environmentally adequate capacity for 5.3 million tons of hazardous waste in 1974 (see Table 13). This compares with an estimated 29 million metric tons of hazardous waste generated by 14 important industries in 1974.[186]

Although research continues on controlling hazardous wastes, one difficulty is that most people simply do not want a solid waste disposal project in their neighborhoods, especially for hazardous material. The Minnesota Pollution Control Agency has a 6-year grant from EPA to demonstrate safe land disposal techniques for potentially hazardous chemicals. The demonstration will establish a data base for full-scale technology applicable to future hazardous waste disposal and will provide EPA with information useful in issuing standards, guidelines, procedures, and regulations.[187] Although a contractor for the planning and conceptual design of the plant has been selected, the state has not yet approved a site because of public concern.

The New Law The RCRA not only establishes the principle of systematic government control of hazardous waste but for the first time involves the federal government directly in solid waste control. It requires a federal or state regulatory, inspection, and enforcement program in every state. However, it encourages the states to accept these and other solid waste responsibilities under federal guidance and provides financial and technical assistance to help them do so.

The Act calls for identification and listing of hazardous wastes and standards of performance for generation, transportation, treatment, storage, and disposal. It includes a manifest system for tracking the waste from the time it leaves the premises of the generator to its final environmentally sound disposal site. Essentially the legislation takes a "pathways approach," which is most concerned with the ultimate path or disposal of the waste. Resource recovery and waste reduction are indirectly affected because cheap, inadequate disposal options will no longer be available.

Deadlines in the Act are extremely optimistic, and they may not be met. There are ambiguities in the law's definition of hazardous waste; requirements for public participation are extensive; and achieving uniformity of rules and regulations from one state to another will not be simple. Further, EPA is moving cautiously in setting solid waste standards and compliance schedules, having learned from experience with the Clean Air and Water Acts that meeting strict standards on a short time schedule is extremely difficult. It is also not clear where the Toxic Substances Act ends and the hazardous waste provisions of RCRA begin (see the previous section on toxic substances).

Success depends largely on whether the states accept responsibility for hazardous waste regulatory programs "equivalent to the federal program" and on whether states adopt reasonably uniform regulations. Federal assistance is the incentive for state compliance. If a state fails to adopt the regulatory program, the law empowers EPA to promulgate one.

Many states reacted favorably to the new law and have passed hazardous waste legislation on their own. A few states—California, Illinois, Kansas, Maryland, Minnesota, New Mexico, Oklahoma, Oregon, Texas, and Washington—already have some type of hazardous waste program. Iowa, Missouri, and Wisconsin are now considering such legislation.

Other Key Provisions of RCRA

In addition to the 20 to 50 million tons of solid waste that could be classified as hazardous under RCRA, several billion tons of other solid waste are generated annually. These too are a potential threat to the environment and public health if they are not properly disposed of. Municipal trash and garbage account for 145 million tons annually; industrial wastes are estimated at 340 million tons. They are dwarfed by mining and agricultural wastes, which account for 1.7 billion tons and 2.3 billion tons respectively.

State and local governments exercise very little control over the numerous land disposal sites for solid waste. Of an estimated 16,000 municipal land disposal sites, only about 5,800 were recognized as complying with state regulations in 1976.[188] In addition, there are sludges from 23,000 municipal waste water treatment plants and 50,000 industrial impoundments which are also unregulated.[189] Leachate from inadequately controlled disposal sites can contaminate ground water supplies, the source of much of our drinking water. In addition to water quality concerns, other health and environmental problems associated with land disposal include fire hazards, air pollution, gas formation, and sanitation problems associated with uncovered garbage.

The Act prohibits new open dumping sites, calls for EPA criteria for sanitary landfills, and requires that all open dumps be closed or upgraded to sanitary landfills by 1983. The Act's restrictions on open dumping are intended to fit into state programs, leaving flexibility in identifying and controlling open dumps to the states.

RCRA also requires the first national inventory of all land disposal facilities which are "open dumps" within the meaning of the Act. Current plans call for the states to notify EPA of all open dump sites, which will then be listed in the *Federal Register*.

EPA is required to publish guidelines to assist states in developing solid waste management plans and to identify regions for solid waste planning. Further, EPA is to set up Resource Conservation and Recovery Panels—teams of technical, marketing, financial, and institutional experts from government and industry—to provide technical assistance to state and local governments upon request. Although the concept of technical assistance is not new to the federal solid waste program, the legislative requirement is.

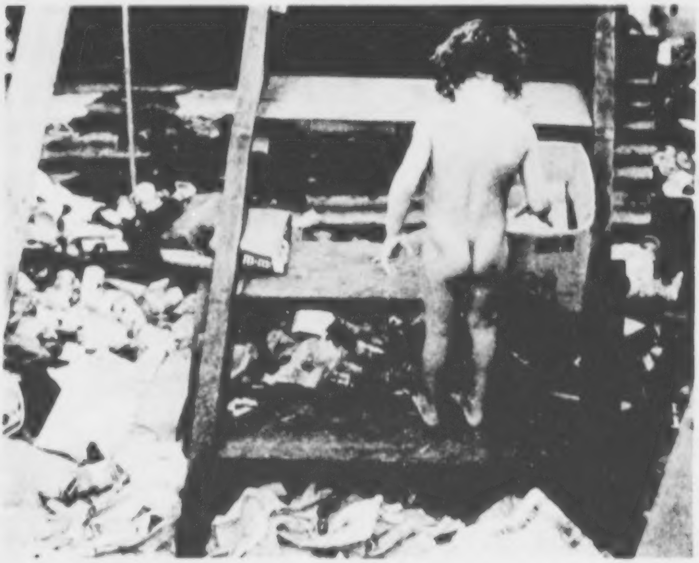
In addition to technical assistance, the law provides financial assistance for the development and implementation of comprehensive solid waste plans which are to include environmentally sound disposal methods and resource recovery and conservation programs.

In developing all the regulations, guidelines, and programs under the Act, EPA is required to provide opportunities for public participation. This is being accomplished through hearings and workshops, advisory and review groups, and public education programs.

The law also requires EPA to conduct a 2-year series of special studies, including studies of incentives and disincentives to resource conservation, to be carried out by the interagency cabinet-level Resource Conservation Committee.

Solid Waste Disposal Charge

One such incentive which the Committee is required to investigate is the solid waste disposal charge. Basically, it is an excise tax on the consumer products entering the solid waste stream. Most charge proposals include three basic features: a charge on consumer products and packaging tied directly to solid waste management costs for the items involved, a special exemption for recycled or recovered materials in products and packaging, and a provision to distribute the revenues to local governments.



Municipal trash and garbage account for 145 million tons of solid wastes annually. Although dwarfed by industrial, mining, and agricultural wastes, they can create environmental and public health hazards.

The charge is an explicit financial incentive for producers and consumers to change, for it is their decisions which determine the solid waste management burden. It is an incentive to reduce waste and increase recycling, and it is a source of public revenue.

The concept of a solid waste disposal charge is supported by most economists and environmentalists and has received the blessing of several special committees and commissions. The National Commission on Supplies and Shortages concluded that "[g]overnments discourage the recycling of containers and paper products by assessing the cost of discarding such materials against general revenues rather than against the price of the containers and paper products." [190] The Commission recommended the disposal charge as one mechanism for directly assessing solid waste collection and disposal costs against the products contributing to municipal wastes.

The Resource Conservation Committee will evaluate the feasibility of the disposal charge concept and make recommendations on products to be covered under a disposal charge scheme, the point in the production process at which to levy a charge, amount of the charge, and use of the revenues generated.

Beverage Container Deposit Legislation

Referenda mandating returnable beverage containers appeared on ballots in four states in November 1976—Colorado, Maine, Massachusetts, and Michigan. The referenda carried in Maine and Michigan and lost in Colorado and Massachusetts.

Several states continue to consider legislation modeled on Oregon's law imposing mandatory deposits on beer and soft drink bottles and cans (see Table 14). The Congress is also considering such action on a national level; companion mandatory deposit bills have been introduced in both the House and Senate.

All federal agencies must report by December 1977 on how they intend to comply with EPA's guidelines requiring a 5-cent deposit on all beverage containers sold at federal facilities.[191] Ten military installations are participating in 1-year tests of the guidelines to evaluate effects on beverage sales. The National Park Service has established deposit systems in more than 200 park areas.[192]

Resource Recovery

In last year's Annual Report, we reported on many demonstration projects for recovery of energy and other valuable resources from wastes. Following is an update of some EPA-funded projects.

The St. Louis and Franklin, Ohio projects are essentially complete and have demonstrated technically feasible processes. Both are being considered in a number of cities, although the Franklin system is being adapted to fuel recovery rather than fiber recovery. Baltimore's pyrolysis plant continued to suffer from scale-up problems. San Diego and Delaware experienced delays, and in San Diego there were

Table 14

State Action on Beverage Container Legislation, June 30, 1977

State	Proposed legislation	Current status
Alaska	Patterned after Oregon law. Mandates 5-cent refund for all beer and soft drink containers except in "bush" areas.	Passed House in April 30 to 5.
California	Patterned after Oregon law. Requires 5-cent deposit on most beer and soft drink containers. Generic containers could have a minimum refund of at least 2 cents. Includes retraining program for displaced workers.	Approved by Senate Committee on Natural Resources and Wildlife 5 to 4; died in Senate Finance Committee.
Connecticut	Five-cent deposit on most bottles and cans, 3-cent deposit on all standardized bottles. House version includes amendment to provide retraining program and special jobless benefits.	Passed House. Petitioned out of Committee in the Senate. Died after Senate and House could not agree on common bill.
Delaware	Two bills under consideration in the House, a deposit bill patterned after Oregon law and litter levy patterned on Washington law.	Narrowly defeated in House 21 to 19.
Massachusetts	Five-cent deposit on all soft drink and beer containers under 1 quart; 10-cent deposit on quantities of 1 quart and over.	Defeated in Senate 19 to 16.
Illinois	Five-cent deposit on all glass and metal beverage containers. Three-cent newspaper tax amendment added on floor.	Approved House Energy Committee. Defeated on floor. Hearings on deposit legislation are continuing at State Pollution Control Board.
Iowa	Five-cent deposit on all beer and soft drink containers; amendment provides retailers with a 1-cent handling fee. Combined with a litter tax, proceeds to be used for public education, research on resource recovery, and establishing redemption centers.	Passed House.
Minnesota	Mandatory 10-cent deposit on all beer and soft drink containers to become effective June 30, 1978.	Tabled in Senate until 1978. Reported to House floor.
Missouri	Five-cent deposit on all beer and soft drink containers, a referendum issue in city of Columbia.	Referendum passed. Study commissioned by state legislature on throw-away container problem to be completed prior to 1978 session.
Nebraska	Deposit legislation.	Tabled in Committee.
New Hampshire	Two bills, both providing 5-cent deposit on beer and soft drink containers. Difference was in refund provided to dealer for handling, a 1-cent refund and a 2-cent refund with all containers to be refilled or recycled.	Both defeated in House.
New Mexico	Straight 5-cent deposit bill initially introduced. Second bill provided for 2-cent deposit on certified containers, 5 cents on noncertified. Redemption centers would be provided.	Both bills defeated in House, narrower margin the second time.
New York	Two bills, mandatory deposit and mandatory deposits on containers sold on state property.	Action stalled on both.
North Carolina	Patterned after Oregon law.	Defeated in House Water and Air Committee 8 to 7.
Washington	Study on effects of deposit law commissioned by House Ecology Committee.	Study due fall 1977. Legislation and referendum planned later.

Source: Sheila Essig, Environmental Action, memorandum to Joyce Kelly, May 20, 1977.

significant cost increases as well. The San Diego plant is now in the startup phase.

Institutional problems caused abandonment of one full-scale EPA-funded demonstration project that had proved technically feasible on a smaller scale. In other projects institutional problems added complications and delay. Union Electric of St. Louis abandoned plans for a full-scale system, the outgrowth of an earlier demonstration, to burn solid waste directly with coal for generation of electricity. The company dropped its plan after Missouri voters adopted "Proposition 1" in November 1976. The proposition, which was in fact aimed at nuclear plants, forbids electric utilities to include in their rates the carrying costs on funds invested in new facilities until the facilities are operating. Another factor in Union Electric's decision was local objection to proposed locations of waste collection-transfer terminals. The company is willing to reactivate the resource recovery system plan if public authorities are willing to help by issuing revenue bonds.

Monsanto, contractor to the city of Baltimore and EPA for the Landgard pyrolysis demonstration project, abandoned the project after 7 years of work, citing continuing mechanical unreliability and the inability to predict clear-cut success. Monsanto recommended that the project be converted to a conventional incinerator. The city has taken over and is continuing to operate the project as a pyrolysis unit at partial capacity, using funds still owed by Monsanto to make additional improvements.

Costs of the San Diego project more than tripled from original estimates of $4 million because of inflation, design modifications, and additional pollution control equipment. Net operating costs of the system are also expected to be high. Although the scaleup from the demonstration project is significant, the planned system is still considered too small to be economical. It will be large enough, however, to predict performance at commercial scale. The project involves a complex technology, and in the process of scaleup it could encounter some of the same problems as the Baltimore system.

The Delaware demonstration project, which is a combined sludge processing-solid waste utilization system, is entering final negotiations with a bidder.

While EPA is wrapping up its current demonstration projects, ERDA's "REFCOM" experimental facility in Pompano Beach is beginning construction. Here the biological gasification of urban solid waste will be mixed with sewage sludge to produce a methane-rich gas. Plant startup is scheduled for late 1977.

Complex technologies with high capital costs, however, will never be feasible for many communities. Most resource recovery is still done through the separation of recyclable materials from other wastes by householders, office workers, and others at the sources of waste generation. Of the roughly 9 million tons of materials recycled per year, more than 90 percent is wastepaper.

The result of recycling at Georgia-Pacific's mill in Kalamazoo is printing papers described as "equal to or better than the original."

To demonstrate the feasibility of source separation at home, EPA assisted Somerville and Marblehead, Massachusetts in securing markets and setting up systems for separate collection of paper, metal, glass, and mixed waste using compartmentalized collection trucks. Ordinances passed by the two communities require citizens to separate their refuse. The recovered materials are sold to a processor under a contract with a guaranteed floor price that was negotiated through open bidding. Extensive public education campaigns helped launch both programs. Thus far, Marblehead is recovering 25 percent of its residential solid waste and Somerville is recovering 8 percent.

Another form of source separation, office paper recycling, is increasingly popular. About 500 organizations are now saving and selling their office wastepaper. Lower waste management costs, less waste volume, and good employee response were among the findings of EPA studies of these programs. EPA guidelines issued in 1976 require source separation of paper at federal facilities.[193] Prototype programs will be initiated in each region of the country by the end of 1977.

Secondary Materials: Aluminum Cans

Alcoa and Reynolds, the two companies that produce approximately 64 percent of U.S. aluminum, collected a record number of used aluminum beverage containers for recycling during 1976. Alcoa recycled 1.61 billion aluminum cans in 1976 and Reynolds 2.4 billion—for nearly 18 cans for each U.S. citizen, or 1 out of every 4 aluminum cans manufactured. More than 87,000 tons were collected, an increase of 25 percent over 1975. Both companies raised from

An Anzo-Barego State Park, California, landscape. In 1976, one out of every four aluminum cans was recycled.

15 cents to 17 cents per pound the amount paid for used aluminum beverage cans and other clean household aluminum items—frozen dinner trays and foil, aluminum siding, gutters, aluminum storm door and window frames, and lawn furniture tubing. Reynolds also provided a toll free telephone number in every state for callers to locate the aluminum recycling collection point nearest them. According to the industry, recycling saves 95 percent of the energy needed to produce metal from ore.[191]

Sludge

Society's wastes are dumped on the land, emitted into the air, and discharged into water. In recent years, however, more has been deposited on land because the Clean Air Act, the Federal Water Pollution Control Act, and the Marine Protection Research and Sanctuaries Act strictly control waste disposal in the air and water. Until passage of the RCRA, land disposal was unregulated. Over the next decade almost every city and industry will have to face the increasingly difficult task of disposing of sludge from municipal waste water treatment plants. As these plants are upgraded, the task of sludge disposal grows. The heavy metal content of some sewage sludges is of particular concern because of possible public health and environmental effects.

Last year EPA's Office of Solid Waste was given lead responsibility for coordinating federal interests in sludge disposal. An action plan for sludge management was prepared in September 1976, and EPA is developing a strategy for dealing with municipal waste water treatment sludges.

NOISE

A National Noise Plan

EPA's first comprehensive national plan for reducing noise was released by EPA Administrator Douglas Costle in May 1977.[195] The plan, "Toward a National Strategy for Noise Control," establishes a framework for decisions on how to fight noise pollution effectively with federal, state, and local efforts (see Figure 5). Its chief goals

Figure 5

Strategy for Noise Control

Goal

Health and welfare

Specific goals

Hearing | Activity interference | Other

General approach

Source standards | In-use control | Consumer decisions | Other, including public information

Principal participants

Federal government | State government | Local government | Consumer and local organizations | Industry | Other

Major sources

Surface transportation (truck, motorcycles, etc.) | Construction (loaders, compressors) | Industrial sites | Aviation | Other

Specific approaches

Inspection programs | EPA new product standards | Labeling | Permits | Property line standards | Other

Source: U.S. Environmental Protection Agency, Office of Noise Abatement and Control, *Toward A National Strategy for Noise Control* (Washington, D.C.: Government Printing Office, 1977), p. 17.

are to eliminate hearing loss resulting from noise exposure, to reduce 24-hour average noise levels immediately to no more than 75 decibels, to achieve reductions to 65 decibels by vigorous regulatory and planning action, to strive for eventual reductions to 55 decibels, and to help other federal, state, and local agencies adopt and implement long-range noise control policies.

EPA is also emphasizing voluntary efforts. The number of state and local voluntary noise control programs increased from 288 in 1973 to 665 in 1976.[196]

Product labeling, an important element in voluntary noise control, enables consumers to choose products that will expose them to less noise. EPA will propose several methods of product labeling in the near future.

EPA's first plan for noise control will be supplemented in coming years by new approaches, such as federal policies to encourage noise buffer zones around transportation facilities, use of quieter equipment for federal construction projects, and protection of workers from hazardous occupational noise levels. A principal continuing effort will be to inform the public about the harmful effects of noise and about methods for reducing noise pollution to acceptable levels.

EPA will also continue its regulatory efforts. During the past year, EPA proposed new product regulations for wheel and crawler tractors, buses, motorcycles, and solid waste compactors. In addition, EPA proposed labeling regulations for hearing protectors (earmuffs to block noise). EPA also issued regulations for the "Low Noise Emission Product Program," under which the federal government will pay a bonus of as much as 25 percent in its purchase of trucks, air compressors, and other products that are especially quiet.

Aircraft Noise

FAA's new aircraft noise regulations will require all aircraft, regardless of production date, to meet the 1968 aircraft noise standards during a phased schedule of 8 years.[197] Aircraft built before the 1968 regulations (more than 80 percent of the fleet) will no longer be exempt.

The Administration has proposed that one-fourth of the present 8 percent federal tax on air fares be used to help airlines retrofit older aircraft or replace them with a new generation of quieter aircraft. The proposal is designed to encourage purchase of new aircraft which would be more fuel efficient and cheaper to operate, thus reducing costs to consumers.

The Airport and Airway Development Act Amendments of 1976 broaden funding eligibility for airport development projects to reduce noise in the "impact zone" adjacent to airports.[198] The Amendments authorize purchase of noise-suppressing equipment, construction of physical barriers, landscaping for reducing noise, and acquisition of land for uses that are compatible with airport operations and noise levels. The FAA is expected to set up an aggressive program to carry

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Companies using quieter construction equipment will receive a bonus from the federal government. So will the people operating and hearing them.

out the noise reduction goals of the new legislation and is encouraging citizens to take an active part in urging operators to participate in the program.

A provision in the Airport and Airway Development Act Amendments of 1976 directs the Secretary of Transportation to study the feasibility, practicability, and cost of soundproofing schools, hospitals, and public health facilities near airports to reduce the adverse effects of aircraft noise. The report, submitted to the Congress in July 1977, concluded that soundproofing is a feasible and practical apprach to mitigating aircraft noise and that the benefits to schoolchildren and hospital patients outweigh the costs.[199] The FAA is now considering action to implement the report recommendations.

In April 1977, the FAA released a draft program environmental impact statement on proposed actions to regulate noise levels of supersonic transports.[200] The actions considered include regulation of the aircraft (Concordes and future SST's) and methods of airport noise mitigation. The EIS considers possible SST operations at a dozen U.S. airports. Although the FAA emphasizes that it is not now considering applications for the airports, they may be able to support SST operations economically and thus represent potential landing sites.

An April 1977 report for Concorde operations at Dulles International Airport confirms forecasts that the plane is noisier than conventional aircraft.[201] Monitoring has demonstrated that the Concorde is approximately twice as loud as a 707 and four times as loud as newer, quieter aircraft such as the L–1011 or the DC–10.

In his decision last year to approve a test for the Concorde, former Transportation Secretary William T. Coleman required the FAA to analyze thoroughly the environmental impacts of all Concorde flights. The FAA monitors the flights to Dulles International Airport and reports monthly. The April report includes community responses to the Concorde as measured by the number of complaints and by public opinion surveys. More than one-half the people polled hear the Concorde as it flies over their homes.

Community responses raise an important issue of how noise is perceived by people and how its impacts should be evaluated. Pro-

Programs are underway to help eliminate aircraft noise by soundproofing buildings and rerouting takeoff and landing patterns. Here, East Boston, Massachusetts.

ponents of the Concorde often point out that total noise levels around busy airports would not be increased significantly. Because Concorde flights are expected to be less than 1 percent of all commercial flights, the estimate is probably correct. However, opponents argue that the daily intrusion of the loud noise from each flight on large populations cannot be justified. The debate, then, depends partly on whether one considers the overall noise increase or individual flights. The FAA survey suggests that the latter is more important because so many people have identified the Concorde's severe noise.

On June 14, 1977, the U.S. Court of Appeals for the Second Circuit ruled that the New York and New Jersey Port Authority has the right to prevent the Concorde from using JFK International Airport.[202] Despite the 1976 Coleman decision, the Port Authority banned Concorde flights from JFK. Overruling a lower court decision that had declared the Port Authority ban unconstitutional, the appellate court instructed the District Court to hold new hearings on whether the ban was reasonable. While court proceedings continued through the summer, the Concorde ban remained effective.

ENERGY

Events of the past year reemphasize the seriousness of the nation's near- and long-term energy problems. After 2 years of lower consumption, U.S. energy use in 1976 rebounded with the recovering economy, rising by 4.8 percent to 74.0 quadrillion Btu's.[203] Demand for oil increased 6.6 percent and natural gas consumption was up 1.3 percent. While consumption rose, domestic production dropped. U.S. production of crude oil declined by 2.7 percent—the fourth straight year of production declines—and imports rose by a steep 21.4 percent. Natural gas production dropped for the third year; the decline was 1.2 percent over 1975.

The bitterly cold winter of 1976–77 severely stressed energy supplies. Natural gas shortages were especially serious, but in some areas output of electricity also dropped. The western drought was responsible for the hydropower decline, and exceptional snow and cold knocked out equipment elsewhere.

The Congress and the President worked together to cope with the immediate crisis. One of President Carter's first acts on taking office was to ask for emergency powers for natural gas; within a matter of days the Congress passed and the President signed the Emergency Natural Gas Act of 1977.[204] The Act set up nationwide allocations for natural gas and allowed higher-priced intrastate natural gas to be sold on the interstate market. The President urged citizens to reduce energy demands by lowering their thermostats. These actions helped, but industries, schools, and stores in several states still had to curtail operations for as long as several weeks.

THE NATIONAL ENERGY PLAN

The President's National Energy Plan, submitted to the Congress in April 1977, is based on the "diagnosis [that] the demand for energy is increasing, while supplies of oil and natural gas are diminishing."[205] The Plan is intended to provide a smooth transition into the era when the world's oil will become far more scarce and costly.

Integral to the National Plan are the following principles:

- Our energy problems must be addressed by a responsible government and by an informed public willing to make necessary sacrifices.
- Healthy economic growth must continue.
- National policies for environmental protection must be maintained.
- The United States must reduce its vulnerability to potentially devastating supply interruptions.
- Energy growth must be restrained through conservation and increased efficiency.
- Prices should reflect the true replacement cost of energy.
- Government policies must be consistent and predictable.
- We must conserve resources that are in short supply and use those that are most plentiful.
- Use of nonconventional sources of energy must be expanded.

The Plan encourages the Congress to adopt seven specific goals, which are to be achieved by 1985:

- Reduce the rate of growth of energy consumption to below 2 percent per year
- Reduce gasoline consumption by 10 percent below its current level
- Reduce oil imports from a potential level of 16 to 6 million barrels per day
- Establish a Strategic Petroleum Reserve of 1 billion barrels
- Increase coal production by about two-thirds to more than 1 billion tons per year
- Bring 90 percent of existing U.S. homes and all new buildings up to minimum energy efficiency standards
- Use solar energy in more than 2.5 million homes.

Creation of a Department of Energy and a centralized energy data bank are important features of the Plan. Healthy competition in the energy industry, protection of low-income citizens from the most severe effects of the energy crisis, and active cooperation among federal, state, and local governments to harmonize the varying economic interests and environmental priorities of different regions are all set forth as leading goals.

Energy conservation is the cornerstone. Besides its other advantages, conservation offers major environmental benefits, reducing adverse impacts at all stages—from resource extraction to end use. Other provisions to help maintain a quality environment are support for stringent environmental standards and emphasis on solar energy, improved technologies for the use of coal, and measures to increase the safety of nuclear powerplants.

The proposal to use substantially more coal raises important environmental questions. Even with more stringent environmental controls and improved technologies, some difficult issues remain. Of concern are underground and surface mining, transportation of coal by railroad and slurry pipeline, air pollution, water pollution, and the disposal of waste material from environmental control technologies. Many of the issues are addressed in the President's Message on the Environment.[206]

OUTER CONTINENTAL SHELF ACTIVITIES

Because onshore areas in the lower 48 states have been extensively explored for oil and natural gas, Alaska and frontier regions of the outer continental shelf (OCS) offer the greatest potential for major new discoveries. But they also present far greater environmental risks and therefore require more stringent environmental safeguards.[207] Special attention must be given to the onshore effects of offshore development—the social and economic impacts on the human environment as well as changes in the natural environment.

Legislation

Several bills to change the 24-year-old OCS Lands Act[208] are currently before the Congress. Both Houses passed amendments to the Act in the last Congress, but the House of Representatives recommitted the conference report.[209] The amendments would permit separate leases for exploration and for subsequent development and production; thus, after oil and gas are discovered, a second decision would determine whether and how development should proceed. Leases could be cancelled where there is likelihood of serious environmental harm and where the advantages of cancellation outweigh those of continuing operations. The role and authority of state and local governments in the leasing program are more fully defined: under the proposed amendments, they may submit recommendations on size and location of proposed sales to the Secretary of Interior, and they must have the opportunity to review development and production plans before approval.

Leasing Schedules

Secretary of Interior Cecil Andrus has substantially revised the OCS leasing schedule announced in January 1977 by outgoing Secretary Kleppe of the previous Administration.[210] Announced May 25, 1977, the new schedule is based upon goals of increased production from offshore areas, high standards of environmental protection, and adequate consultation with affected states and time for planning.[211]

Of the 25 previously announced sales scheduled through 1980, 17 were postponed for further study. The new schedule runs only through December 1978 and includes one sale in Alaska's Cook Inlet (rescheduled from February to October 1977), one each in the North, Middle, and South Atlantic, and four in the Gulf of Mexico. Seven of eight sales previously announced for the Alaska OCS were left off the new timetable; they were in the Kodiak area, the Beaufort Sea, the Bering Sea, and the northern Gulf of Alaska. Other sales dropped were off southern California and in the South Atlantic. The Secretary wished to take a closer look at the environmental risks and to provide the affected states with more time to respond to possible future sales.

Secretary Andrus has appealed a federal District Court decision [212] voiding the August 1976 mid-Atlantic lease sale in which 530,000 acres 50 to 90 miles off New Jersey were sold for $1.13 billion. The District Court held that the environmental impact statement was inadequate because it ignored the practical effects of local government land use powers on OCS facilities and because it failed to consider the effects of specific pipeline routes. The Secretary is appealing "in the public's interest." [213]

OIL POLLUTION FROM TANKERS

After a series of major tanker accidents last winter, oil pollution from tankers became an important public and political issue. Of particular concern were the spill from the *Argo Merchant*, which grounded 29 miles off the Massachusetts coast and lost 26,000 tons (7.5 million gallons) of heavy fuel oil, and the explosion of the *Sansinena* in Los Angeles Harbor, with a loss of eight lives. These and several other accidents drew public attention to the risks of tanker spills.

President Carter's program to reduce oil pollution from tankers, announced March 17, 1977,[214] included measures to deal with accidental spills and with pollution from normal operations such as deballasting and tank cleaning. It is also intended to improve cleanup after oil spills and to provide full and dependable compensation to victims of oil pollution damage. New legislation with similar goals is before the Congress. One of these bills, the Tanker and Vessel Safety Act, was unanimously approved by the Senate in May 1977.

The President proposed several national and international measures to achieve his objective.[215] He directed the Secretary of Transportation to develop new rules for improved construction and equipment of oil tankers, U.S. and foreign, entering our ports. The proposed requirements, issued by the Coast Guard on May 16 in draft form,[216] include segregated ballast for all tankers over 20,000 dead-

The farthest north ice-free port on the continent, Valdez is an important "break-in-bulk" point for North Slope oil.

weight tons, double bottoms for new tankers of the same size, improved emergency steering standards, and backup radar systems with collision avoidance equipment. The President asked for strong efforts to achieve international agreement on these measures and to improve the present international system for tanker inspection (see the later section on the global environment in this chapter for discussion of international efforts to reduce tanker-caused pollution).

The Message on Oil Pollution of the Oceans also called for better qualified crews on the tankers entering our ports. It directed the Coast Guard to board and examine all foreign flag tankers entering U.S. ports, noting any failures to meet safety and environmental requirements, and to record the information in a computer storage bank with other data on accidents and pollution incidents. Thus ships that are a pollution hazard can be identified and excluded from U.S. ports if necessary. The President also urged the Congress to ratify the International Convention for the Prevention of Pollution from Ships, which was signed in 1973 by the major maritime powers but has not yet been ratified by any of them. The Convention requires segregated ballast on new large tankers over 70,000 deadweight tons and places strict controls on oil discharges from ships.

The Administration has also submitted to the Congress the Comprehensive Oil Pollution Liability and Compensation Act of 1977; several other bills cover the same subject. The proposed Act would replace fragmented federal and state oil spill liability laws and compensation funds with a single nationwide system. The Act establishes strict liability for oil spills, assures full compensation to victims of all oil pollution damage, including damage from spills of unknown origin, and provides for a $200 million fund to ensure coverage of all cleanup and damage costs. Further, the Coast Guard, EPA, and other involved agencies are to review and upgrade their existing oil spill response capabilities.

WEST-TO-EAST TRANSPORT OF ALASKAN OIL

When the Trans-Alaskan Pipeline Act became law in 1973, industry and government predicted that west coast demands would absorb most of the North Slope production, and no plans were made for distributing the oil to other parts of the country. Today it appears that one-quarter to possibly one-half of the oil flowing from Valdez, Alaska, by late 1978 will be surplus on the west coast. Of an expected 1.2 million barrels per day, 300,000 to 700,000 will have to be delivered elsewhere. Later, when the oil deliveries to Valdez in 1985 reach 1.6 to 2 million barrels a day, the west coast surplus may be still larger.[217]

Reasons for the surplus are: reduced rates of growth in energy consumption, production from the Elk Hills Naval Petroleum Reserve, anticipated production from the California OCS, and increased production from existing fields with use of secondary recovery. In addition, west coast refineries are limited in their capacity to use Alaskan crude, having been designed to handle the lighter, lower sulfur Indonesian "sweet" crude.

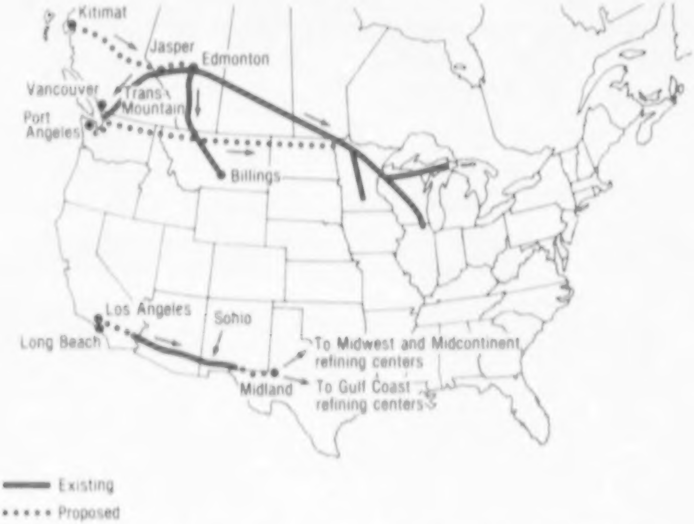
The Federal Energy Administration has considered a wide range of alternatives for delivery of Alaskan oil to the oil-scarce Midwest and East, including various pipeline routes (see Figure 6), transport by supertanker to the Panama Canal and transfer to smaller tankers there; carriage around Cape Horn by supertanker; overland transport by train; exchange with Canada for oil or with Japan for imported Persian Gulf or Indonesian oil.[218] In view of California's impending surplus, conservation of the huge Alaskan oil resource has been suggested—that is, stretching out the time for exploring and developing areas other than the currently active Prudhoe Bay fields. The North Slope oil that will fill the TAPS pipeline is on state lands, but much of Alaska's unexploited oil is under federal lands and waters. Federal decisions, then, will be crucial.

One alternative for delivering North Slope oil is the Standard Oil Company of Ohio (SOHIO) proposal to land 500,000 barrels per day at Long Beach, California, and transport it to Midland, Texas, by an existing natural gas pipeline converted to flow the other way, from west to east. The oil could be distributed from Midland. The system, awaiting a decision by the Federal Power Commission, would involve construction of 236 miles of new pipeline and conversion of 790 miles of existing pipeline and would require 16 months to complete.

The chief argument against the SOHIO proposal is the threat to air quality. Unloading oil from tankers and storing it in tanks at Long Beach could increase hydrocarbon pollution in an area that is already

Figure 6

Proposed Pipeline Routes


Kitimat
Jasper
Edmonton
Vancouver
Trans Mountain
Port Angeles
Billings
Los Angeles
Sohio
Long Beach
To Midwest and Midcontinent refining centers
Midland
To Gulf Coast refining centers
Existing
Proposed

Source: Chevron U.S.A., Inc., *Chevron Briefings: North Slope Oil and the West Coast* (San Francisco, 1977), p. 6.

plagued with smog. In tankers without segregated ballast, hydrocarbon vapors are released as the ballast water is taken aboard and rises in the oily cargo tanks. (If ballast is carried in clean tanks that never hold oil, this problem does not arise.) Hydrocarbon emissions from other tanker operations and oil storage are expected to be relatively small; yet they would be a distinct addition to air quality problems in an area which experiences severe, frequent violations of the primary oxidant standard established to protect human health. Further, fuel burned in tanker boilers could cause problems of sulfur and nitrogen oxide emissions. For these reasons, the California State Air Resources Board has opposed the SOHIO proposal.[210]

SOHIO has attempted to follow the "emission offset" policy of EPA for situations in which increments to pollution would worsen preexisting air quality problems. SOHIO proposes to install pollution abatement equipment at existing facilities such as older oil storage tanks in order to reduce their emissions by equal or greater amounts than the new air pollution generated from the proposed transport system. In such situations EPA also requires best available mitigating measures. Here these could include segregated ballast and inert gas systems (slated to be required in any case within a few years by the President's tanker program and legislation now before the Congress), avoidance of purging vapors from cargo tankers in or near port in the south coast air basin around Los Angeles, and use of low sulfur fuels and exhaust scrubbers for tankers.

The possibility of damage from oil spills, also brought up in connection with the SOHIO project, exists wherever oil may be landed, whether it be in Long Beach or San Francisco Bay, at Port Angeles near Seattle, or in Canada at Kitimat, British Columbia. Port characteristics make a big difference in the risk of oil spills, however. Local wind, weather, and current conditions and such hazards as rocky shores affect the safety of tanker passage. So does the amount of local ship traffic. Further, how serious the effects of an oil spill may be depends very much on the biological, recreational, and esthetic values of a particular area.

Such considerations should count a great deal in determining where and how Alaska oil is to be unloaded and transported eastward from the west coast. Environmental impact statements for major related federal actions and permits provide a means for thorough scrutiny by the public as well as by government officials of each alternative.

ALASKA NATURAL GAS

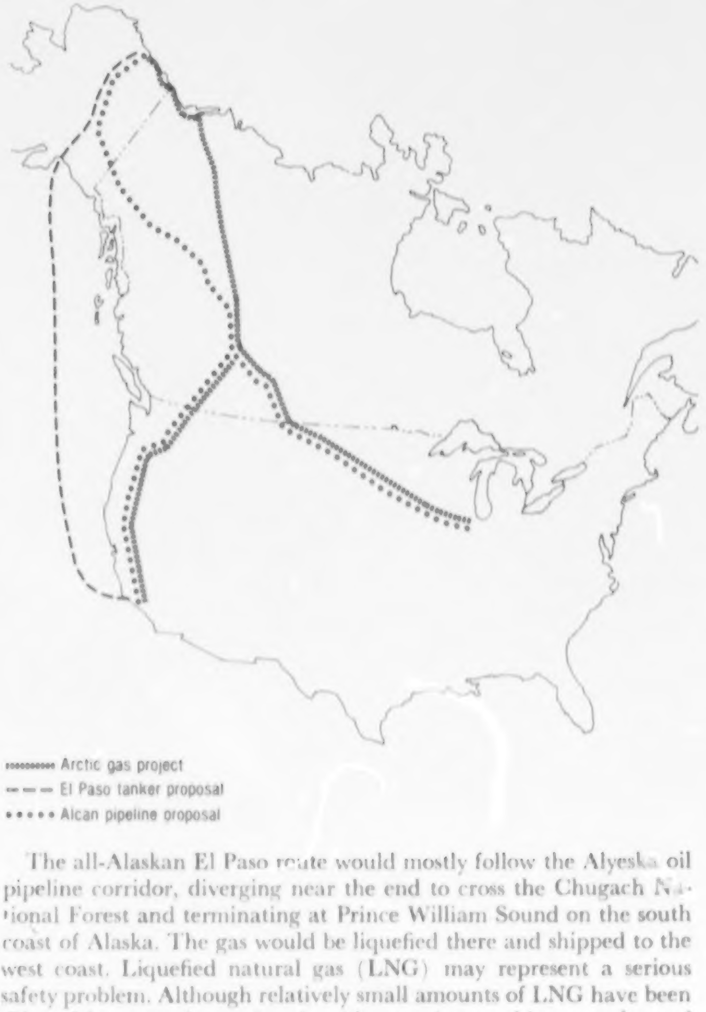
Large amounts of natural gas are present in the petroleum-rich North Slope. The 200-square mile Prudhoe Bay field contains an estimated 22.5 trillion cubic feet in proven natural gas reserves, which is about equal to 1 year's current U.S. consumption. Oil production began in the summer of 1977, but no decision had yet been made on whether or how to transport the gas to market in the lower 48 states.

The three competing transportation routes, proposed by the Alaskan Arctic Gas Pipeline Company, the El Paso Alaska Company, and the Alcan Pipeline Company, are shown in Figure 7. All three would inflict significant environmental damage, but the impacts differ substantially in kind and degree. More fundamentally, they raise questions about our ability to preserve the wilderness and culture of the Far North in the face of growing demands for energy.

The Arctic overland route would require some 4,000 miles of pipeline construction, much of it through untouched wilderness in Canada as well as Alaska. The route would cut across the entire Arctic National Wildlife Range, the only unspoiled area of its kind in the United States and a unique natural, scientific, and esthetic resource. In addition to immediate, irreversible damage, a long-range effect might be to open the range to further oil and gas development. For these reasons, environmental groups strongly opposed this route. The Canadian National Energy Board recommended against it because the environmental impacts and social effects on northern native cultures were unacceptable. The arguments in favor of it were reliability, capacity to handle large volumes of gas, and direct delivery to the Midwest.

Figure 7

Proposed Arctic Natural Gas Transportation Routes



The all-Alaskan El Paso route would mostly follow the Alyeska oil pipeline corridor, diverging near the end to cross the Chugach National Forest and terminating at Prince William Sound on the south coast of Alaska. The gas would be liquefied there and shipped to the west coast. Liquefied natural gas (LNG) may represent a serious safety problem. Although relatively small amounts of LNG have been shipped for more than a decade without serious problems, analyses of the risks and consequences of an LNG tanker accident are not conclusive. In addition, the processes of liquefaction and gasification release substantial amounts of waste heat and waste coolness to air or water, with possible adverse impacts to the environment. Further, the El Paso route involves some destruction to a magnificent untouched, although not unique, area of the Chugach National Forest.

Because the Alcan route would follow existing transportation corridors—the oil pipeline to Fairbanks and the Alaska Highway into Canada—it involves no large-scale intrusion into wilderness. Originally developed by the Interior Department in its environmental impact statement as a possible alternative, this route was considered environmentally superior by the staffs of both the Interior Department and the Federal Power Commission. The Canadian National Energy Board approved the Alcan route, but with several conditions, including requirements that the applicants develop plans to link the pipeline with Canada's MacKenzie Delta gas reserves and that a considerable portion of the pipeline be under Canadian ownership.

The Alaska Natural Gas Transportation Act of 1976 [220] reflected congressional concern for a prompt and sound decision on which—if any—of the systems should be constructed. Ultimate authority to make the decision was assigned to the President and the Congress rather than to the Federal Power Commission, the Department of the Interior, or other permitting agencies. The Act also precluded judicial review of the proposed transport system environmental impact statements, instead directing CEQ to hold public hearings on the statements and report to the President on the "legal and factual" sufficiency and other matters related to environmental impacts.

The FPC made its recommendations to the President on May 1, with two Commissioners favoring the Arctic route and the other two choosing the Alcan proposal. The FPC found all three routes environmentally acceptable.

On July 1 CEQ reported that the environmental impact statements were legally and factually sufficient under the National Environmental Policy Act but only for selection of a corridor and basic

A valley west of the pipeline route in the upper Atigun Valley.

technology of a gas transportation system. The safety and environmental implications of LNG facility siting, route alignments, project designs, mitigation measures, and other such decisions must still be carefully assessed. Environmental assessments, EIS supplements or new impact statements may be required, depending upon the significance of impacts and the degree to which they have already been treated.

The Council disagreed with the FPC conclusion that all three systems were environmentally acceptable, finding the Arctic route most destructive and the Alcan route most acceptable; the future of the Arctic National Wildlife Range should lie in its permanent dedication to wilderness and wildlife values. An interagency task force on environmental issues, led by the Interior Department, concluded that the environmentally superior choice was not to build any of the three competing transportation systems. The task force agreed, however, that on environmental grounds the Alcan route was least damaging, with the El Paso system ranking next.

On September 22 the President recommended to the Congress that the Alcan route be selected; the Congress accepted his recommendation.

NUCLEAR ENERGY

Developments in U.S. nuclear policy in the past year point to a new caution and restraint. In April President Carter announced a major redirection of policy, proposing to avoid nuclear proliferation and postponing use of plutonium as a commercial fuel. The National Energy Plan indicates that the nation must count on nuclear power to meet a share of our energy needs but emphasizes increased attention to reactor safety, siting, licensing, and waste management. Meanwhile, financial difficulties continued to trouble the nuclear power industry in the past year, and growth projections were again revised downward.

Redirecting Nuclear Policy

The spreading capability to make atomic weapons, other hazards of plutonium, and unresolved questions of managing long-lived, highly radioactive nuclear wastes continue to be at the center of concerns about nuclear power. Plutonium poses a threat not only because it could be used to make illicit nuclear weapons but also because of its extreme toxicity. In addition, it is questionable whether recycling plutonium for use as a nuclear fuel makes economic sense or whether it is needed as an energy resource at this time.

In January 1977 President Carter ordered a comprehensive review of the weapons proliferation consequences of nuclear energy policies. An earlier review by the Ford Administration had resulted in policy shifts toward greater caution in the use of plutonium and a new awareness of the waste problem.[221] The President's statement on nuclear power policy in April contained seven principal points: [222]

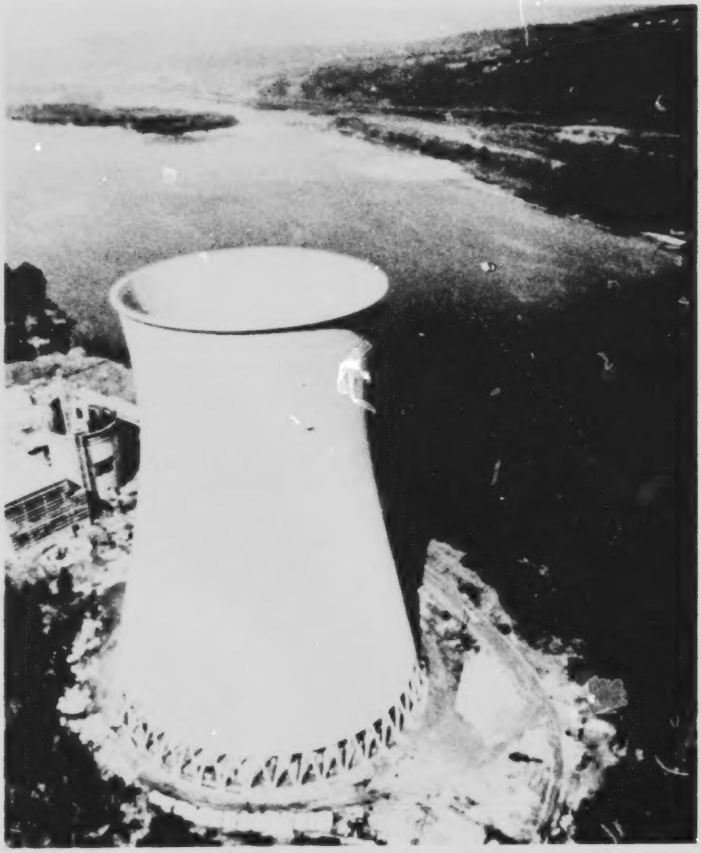
> *First*, we will defer indefinitely the commercial reprocessing and recycling of the plutonium produced in the U.S. nuclear power programs. From our own experience we have concluded that a viable and economic nuclear power program can be sustained without such reprocessing and recycling. The plant at Barnwell, South Carolina, will receive neither federal encouragement nor funding for its completion as a reprocessing facility.
>
> *Second*, we will restructure the U.S. breeder reactor program to give greater priority to alternative designs of the breeder other than plutonium, and to defer the date when breeder reactors would be put into commercial use.
>
> *Third*, we will redirect funding of U.S. nuclear research and development program to accelerate our research into alternative nuclear fuel cycles which do not involve direct access to materials in nuclear weapons.
>
> *Fourth*, we will increase U.S. production capacity for enriched uranium to provide adequate and timely supply of nuclear fuels for domestic and foreign needs.
>
> *Fifth*, we will propose the necessary legislative steps to permit the U.S. to offer nuclear fuel supply contracts and guarantee delivery of such nuclear fuel to other countries.
>
> *Sixth*, we will continue to embargo the export of equipment or technology that would permit uranium enrichment and chemical reprocessing.
>
> *Seventh*, we will continue discussions with supplying and recipient countries alike, of a wide range of international approaches and framework that will permit all nations to achieve their energy objectives while reducing the spread of nuclear explosive capability. Among other things, we will explore the establishment of an international nuclear fuel cycle evaluation program aimed at developing alternative fuel cycles and a variety of international and U.S. measures to assure access to nuclear fuel supplies and spent fuel storage for nations sharing common non-proliferation objectives.

The United States will support an international program to develop alternative nuclear fuel cycles that offer greater resistance to proliferation and diversion to nuclear weapons materials. An additional goal would be to ensure access to nuclear fuel supplies and spent fuel storage for nations sharing common nonproliferation objectives. As of July, about 30 countries had joined this program.

The President proposed to defer indefinitely the Clinch River Breeder Reactor project, which is designed to use plutonium as fuel, but to continue basic research and development on the liquid metal fast breeder reactor and alternative breeder reactor designs.[223] However, by midyear the Senate had voted compromise funding to continue development and preparation for the Clinch River project but to postpone any licensing or construction at least until next year.

He also proposed that no federal funds—and no encouragement—be given to the Barnwell, South Carolina, spent fuel reprocessing plant to produce plutonium. The Congress at midyear was in the process of providing funds to study the potential contribution of the Barnwell plant to the international fuel cycle evaluation program.

Besides using more coal, the nation must also rely on nuclear power, employing the "proven technology" of light water reactors



The Trojan nuclear powerplant on the Columbia River near Prescott, Washington.

"to offset a share of the nation's energy deficit without undue risks of proliferation."[224] The fundamental objectives will be a part of the nuclear power program: first, to search for advanced nuclear technologies that minimize the risk of nuclear proliferation and to defer any commitment to recycling plutonium in light water reactors or to the plutonium breeder reactor and, second, to increase attention to light water reactor safety, siting, licensing procedures, and waste management.

Some of our past problems with nuclear energy have arisen because nuclear policy was viewed in isolation rather than as part of a larger energy policy, interconnected with environmental and economic policies. Another failure was inadequate attention to public views. A national conference on nontechnical aspects of nuclear waste management, held in October 1976, included discussions on the legal, social, environmental, and public policy issues relating to nuclear waste.[225]

Industry Developments

Once again, projections for the amount of installed nuclear power have been revised downward, and one reactor manufacturer, General Electric, has considered dropping out of the market.[226] NRC and FEA now project a range of 100,000 to 120,000 megawatts electric total installed nuclear capacity in 1985, compared to the 130,000 to 160,000 megawatts projected a year earlier.[227] The revisions appear to result primarily from financing problems and continuing low electrical demand growth.

On the state level, initiatives to restrict development of nuclear power were defeated on the November ballots in six states: in Arizona, by 70 percent; in Colorado, 71 percent; Montana, 58 percent; Oregon, 58 percent; Ohio, 68 percent; and Washington, 67 percent.[228] Opponents won a victory on a related issue in Missouri, where a proposition that could slow nuclear power growth passed by 61 to 39 percent. The voters approved a measure forbidding electric utilities to include the cost of construction work in progress in current rate bases.[229]

A few months earlier, a California initiative was defeated 2 to 1, but legislation was passed prohibiting further nuclear expansion until questions regarding radioactive waste disposal have been resolved and the underground siting of nuclear reactors has been studied.

The Seabrook Controversy

The controversy over building twin nuclear 1,150-megawatt units at Seabrook, New Hampshire, centered on protection of marine life near the plants, but it also reflected much broader concerns of opponents to nuclear power. The once-through condenser cooling system of the proposed plant, which would withdraw some 1.2 billion gallons of seawater daily and return it 39° warmer, was approved in 1975 by EPA's Region 1. But late in 1976, in light of questions raised by an intervenor regarding the scientific data submitted in support of the proposed cooling system, the Regional Administrator reversed his preliminary determination, holding that the studies were an inadequate basis for his decision regarding the effects of a once-through system on local marine life. Subsequently, the Nuclear Regulatory Commission approved suspension of the construction permit on the ground that the outcome of an appeal to the EPA Administrator was uncertain.

In August 1976, for the first time, there was civil disobedience in the antinuclear movement, and two demonstrations at Seabrook resulted in 117 arrests.[230] Again on May 1, 1977, 1,250 demonstrators led by members of the Clamshell Alliance, an antinuclear group, were arrested during a "peaceful occupation" of the nuclear plant construction site.[231]

Expressly limiting his ruling to the narrow issue before him, EPA Administrator Douglas Costle on June 17, 1977, reversed the Regional Administrator's ruling and approved a once-through cooling system for the plant at Seabrook.[232]

Other Events

Calling attention to losses of nuclear weapons-grade material from nuclear fuel cycle facilities as disclosed by accounting systems, the Natural Resources Defense Council petitioned the NRC to take emergency measures to protect these materials or to revoke the licenses of facilities without adequate protection. NRC denied the petition in January 1977 but stated that it was upgrading security of all nuclear fuel cycle facilities and promised improved safeguards through regular rulemaking proceedings with public participation.[233] In February the Commission announced detailed requirements for physical protection of nuclear powerplants against sabotage or armed attack.[234] In June the NRC staff began a new review of safeguards at nuclear fuel cycle facilities with the objective of preventing sabotage and theft of highly enriched uranium and plutonium. This evaluation will extend through 1978.[235]

Following a court decision that its basis for considering impacts of the nuclear fuel cycle outside the powerplant were inadequate,[236] NRC halted all nuclear powerplant licensing from August to November 1976. The U.S. Court of Appeals for the District of Columbia held that NRC's rule on the impacts from nuclear fuel reprocessing and radioactive waste management were based on an inadequate record and should be more fully documented. These and other environmental effects of the whole nuclear fuel cycle are factored into the cost-benefit assessments that appear in the environmental impact statement for individual nuclear reactors.

In stopping the issuance of licenses, NRC directed its staff to review the technical literature and produce a revised and adequately documented survey on the probable effects of reprocessing and managing waste.[237] NRC published a new analysis and proposed an interim rule responding to the Court's decision in October [238] and resumed licensing in November.

NRC hearings on the environmental impacts of the uranium fuel cycle were reopened May 24, 1977.

NATURAL RESOURCES

In its closing days the 94th Congress passed several long-awaited measures for conservation and balanced management of natural resources. The Bureau of Land Management, the nation's largest land manager with nearly one-half billion acres of public lands under its care, was finally given legislative direction and strong authority by the Federal Land Policy and Management Act of 1976.[239] The National Forest Management Act of 1976 [240] permanently established the National Forest System and gave extensive guidance for its management. The National Park System benefited from several new laws that establish new parks, require regular review of potential park areas, require annual program and management plans for individual parks, and prohibit new mining in parks. The Congress and the states also added to the Wilderness and Wild and Scenic Rivers Systems.

The Carter administration followed these achievements with a number of new policy initiatives, including measures to establish a comprehensive national water resources policy, to review the management of forests on private lands, and to protect important ecological resources such as wetlands and barrier islands. The Administration also proposed to reform outdated laws governing mining on the public lands and to protect our public lands and natural resources from destructive use.

Efforts to manage public lands under the BLM Organic Act will help preserve the land for all citizens. Here, Ft. Darling, near Richmond, Virginia, and on the facing page, Yellowstone Park around 1915.

PUBLIC LANDS MANAGEMENT

Federal Land Policy and Management Act of 1976

After years of debate the Congress passed the Federal Land Policy and Management Act of 1976, also known as the BLM Organic Act.[211] The Act officially ends the policy of conveying public lands into private hands and announces the federal government's intention to retain most of the 473 million acres of Bureau of Land Management lands and manage them for the long-term benefit of all citizens. They shall be managed for multiple use and sustained yield in a manner to protect their scientific, scenic, historical, ecological, environmental, air and atmospheric, water resources, and archeological values.

The Act calls for prompt action to protect land areas of critical environmental concern. Land use plans consistent with the purpose of the Act must be developed promptly and with adequate public involvement. The Act also brings BLM into the Wilderness Preservation System, requiring the review and recommendation to the Congress of suitable areas from its immense holdings within 15 years. In short, the Act gives BLM much needed authority to protect and manage its vast national trust. The Department of the Interior is developing regulations for full implementation.

National Forest Management Act of 1976

After controversy and litigation on National Forest timber practices (described in our 1976 Annual Report), the National Forest Management Act of 1976 won praise from both environmental groups and industry.[242]

The Act gives statutory permanence to the National Forests and sets broad requirements for their management. Diversity of plant and animal communities suitable to specific land areas must be maintained: timber may be harvested only where soil or other watershed conditions will not be irreversibly damaged; and streams, stream banks, shorelines, lakes, wetlands, and other water bodies must be protected from detrimental changes in water temperature, blockages of water courses, and deposits of sediment. The law requires timber harvesting on a sustained yield basis so that no more timber is removed each year than new growth can replace, it mandates silvicultural standards which ensure that stands of trees will not generally be harvested until they are mature (although thinning and other stand improvement work is permitted), and it places specific limitations on clearcutting. The Act also requires standards and guidelines for land management plans, public involvement in developing the plans, and resource plans, resource permits, and contracts that are consistent with the plans.

With this law comprehensive legislation for better forestry management on federal lands is complete. The greatest remaining challenge to U.S. forestry is to improve the condition and production of private forest holdings. Nonindustrial private commercial forests comprise some 296 million acres—59 percent of all commercial forest lands—and are owned by over 4 million people.[243] The President has ordered a review to determine how federal programs can encourage better management of the lands.

National Parks

The 1976 amendments to National Park law[244] mandated continual review of new areas for possible additions to the National Park System and established congressional oversight of development in existing parks. Under the amendments, the Secretary of Interior must study and monitor areas with outstanding resources which may one day qualify for inclusion in the National Park System. Each year a detailed program for the development of facilities for each unit of the NPS must be sent to the Congress. These plans must be consistent with the general management plan for each unit, which the Act also requires.

Since July 1976, the National Park System has gained three new areas, the Congaree Swamp National Monument [245] and the Ninety Six National Historic Site [246] in South Carolina and the Monocacy National Battlefield [247] west of Washington, D.C., in Maryland.

When the 58,000-acre Redwood National Park was established in 1968,[248] unfortunately the boundaries left the Redwood Creek portion at the southern tip of the Park especially vulnerable to damage from logging and roadbuilding outside the Park. As the situation reached a critical stage in 1977, a bill to enlarge the Park was introduced in the Congress,[249] and Secretary of Interior Andrus asked the timber companies to stop logging for 6 months while remedial legislation could be considered. The moratorium was rejected.

Subsequently the Administration proposed that 48,000 carefully chosen acres should be added to the Park both to protect existing parkland and to increase the Park's stands of redwoods.[250] The proposed bill would authorize the Secretary of Interior to issue special rules and regulations to control activities on critical lands adjacent to the Park if he finds existing state regulations inadequate. Also included in the proposal is repair from past abuses to Redwood Creek Watershed and special efforts to mitigate any temporary loss of jobs and incomes that may result from closing the lands to private logging.

Conclusion

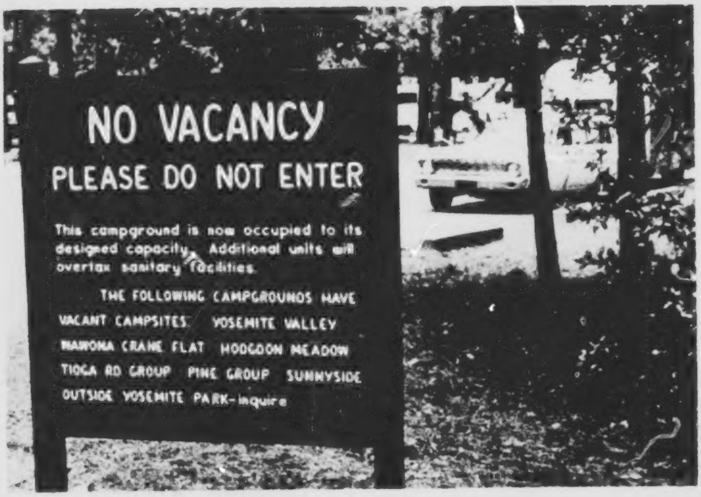
By the end of the year the only federal public lands system that still lacked an organic act giving adequate direction for management and planning is the National Wildlife Refuge System.

Of historic dimensions is the opportunity to conserve large unspoiled sections of our wilderness in Alaska. Under terms of the Alaska Native Claims Settlement Act, the Congress is to consider designation of major additions to the National Park, Forest, Wildlife Refuges, and Wild and Scenic Rivers Systems.[251] The 95th Congress is considering legislation to establish these new areas.

Most significantly, the Administration is committed to a policy of effective stewardship of our public lands and natural resources, including conservation, multiple use of resources, and a reluctance to disrupt natural ecosystems.

OUTDOOR RECREATION

Use of federal and state public lands for outdoor recreation grew after World War II and has been increasing steadily ever since. The number of visitors and their activities have been difficult to estimate because the seven land-managing agencies used several different


NO VACANCY
PLEASE DO NOT ENTER
This campground is now occupied to its designed capacity. Additional units will overtax sanitary facilities.
THE FOLLOWING CAMPGROUNDS HAVE VACANT CAMPSITES: YOSEMITE VALLEY
WAWONA CRANE FLAT HODGDON MEADOW
TIOGA RD GROUP PINE GROUP SUNNYSIDE
OUTSIDE YOSEMITE PARK-inquire

Signs like this one are encountered with increasing frequency in campgrounds and parks.

standard units of recreation measurement. But now the agencies are submitting recreation data to the Bureau of Outdoor Recreation in the same unit of measurement—visitor hours and recreation days.[252]

With more accuracy and standardization of reporting procedures, BOR reported a slight decrease (2.8 percent) in total visitor hours in 1976, a change which probably does not represent any real decrease in the use of these lands. Total visitor hours in 1976 were approximately 6.8 billion.[253]

The Land and Water Conservation Fund Amendment

The new Land and Water Conservation Fund Act, signed by former President Ford in September 1976, authorized more than $10.3 billion for state and federal outdoor recreation and historic preservation over the next 12 years.[254] The Fund was to be expanded incrementally, from $300 million in 1976 and 1977 to $600 million in 1978, $750 million in 1979, and $900 million for 1980–89. In June 1977 the Act was again amended to raise the funding authorization to $900 million for fiscal year 1978 and 1979 immediately.[255] The amendment would allow faster action to reduce the land acquisition backlog—that is, the areas authorized for inclusion but not yet acquired—in the National Park System, Wilderness Preservation System, Wild and Scenic Rivers System, Trails System, and Recreation Areas.

Urban Recreation

The United States is an urban nation. In 1975, although nonmetropolitan counties comprised 79 percent of the total number of

U.S. counties and 85 percent of the land, they contained only 27 percent of the total population.[256] Typically, metropolitan areas provide limited outdoor recreation opportunities, particularly for inner-city residents. In January the Department of the Interior published a "Preliminary Urban Parks Study," which discusses how the federal government could provide urban recreation and open space. It recommends changing the Land and Water Conservation Fund grant formula to be more responsive to urban needs: offering federal incentives to promote cooperation among the many local agencies with recreation responsibilities in a given SMSA (Standard Metropolitan Statistical Area), establishing a federal low interest revolving loan fund to help local agencies respond quickly to land acquisition opportunities, and buying significant lands near SMSA's and keeping them in a landbank until the states or communities can take them over.[257]

National Trails System

Many routes used by early settlers are now highways, but others are still paths through country that has changed little in 200 years. Although the National Trails System Act of 1968 established a national system of recreational and scenic trails,[258] only the Appalachian and Pacific Crest Trails have been designated by the Congress as National Scenic Trails.

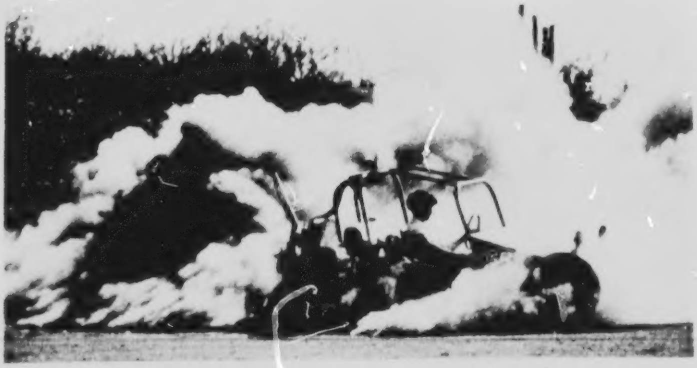
By the end of fiscal year 1977, studies on all 14 original "Scenic Study Trails" designated by the Act will be complete.[259] Legislation designating three of them—the Continental Divide, North Country, and Potomac Heritage Trails—as additions to the System has been submitted to the Congress by the President.[260]

Because trails whose prime value is historical have special attributes that were not adequately covered in the National Trails System Act, a new category of "National Historic Trails" has been proposed.[261] Prime candidates are the Lewis and Clark and Oregon Trails.

The National Trails System Act[262] authorizes the Secretary of Interior or the Secretary of Agriculture to designate certain state, local, private, and federal land trails as National Recreation Trails. So far, 116 Recreation Trails extending over 1,000 miles are included.[263]

Off-Road Vehicles

ORV use continues to grow. In the National Forests motorcycle and snowmobile use has greatly increased in the past decade and the trend continues (see Table 15). Annual statistics for lands managed by the Bureau of Land Management are not available, but BLM believes that over one-half of all ORV use on U.S. public lands is on BLM lands,[264] on which ORV use in 1972 was estimated at more than 12.25 million visitor days. It is further estimated that more than 10 million persons used almost 5.5 million motorcycles off-road on both the public and private lands.[265] Snowmobile users probably



The resource damage caused by off-road vehicles has continued to grow in the last decade.

number over 6.5 million.[266] No figures are presently available on off-road use by 4-wheel drive vehicles.

ORV users are a small percentage of the total population, but the resource damage that they cause is out of proportion to their numbers. ORV's have invaded a variety of lands—from deserts and coastal sand dunes to forested mountains and fertile plant and wildlife habitats.

Because it provides a challenge, the terrain that appeals to many ORV riders often includes steep slopes. In Ballinger Canyon, Los Padres National Forest, ORV's have caused extensive erosion by destroying protective plant cover.[267]

Table 15

Motorcycle and Snowmobile Use on National Forest Lands, 1965 and 1972–76

Year	Motorcycles			Snowmobiles		
	Total visitor days (thousands)	Percent change from previous year	Percent change from 1965	Total visitor days (thousands)	Percent change from previous year	Percent change from 1965
1965	1,478.8			515.6		
1972	2,910.2		+96.8	2,862.6		+455.2
1973	3,137.7	+7.8	+112.2	3,258.0	+13.8	+531.9
1974	3,580.3	+14.1	+142.1	3,022.5	−7.2	+486.2
1975	3,840.0	+7.3	+159.7	3,276.0	+8.4	+535.4
1976	4,140.4	+7.8	+177.5	3,340.9	+2.0	+548.0

Source: U.S. Department of Agriculture, Forest Service, "Estimated National Forest Recreation Use Servicewide Summary," 1966, 1973, 1974, 1975, 1976, 1977.

Eighteen years of vehicle use in the Red Rock Canyon Area, California, has resulted in extensive loss of soil mantle, with gullies 7 feet deep.[268] In addition to causing plant destruction, soil erosion, and gullying, ORV's can adversely affect soil moisture, water quality, and wildlife habitat. Often they conflict with other nondestructive uses.[269] Reclamation is a very difficult and costly task, and natural recovery on some soils is slow.

Because of the damage, the President issued an Executive order, "Off-Road Vehicles on Public Lands," reproduced in Appendix A.[270] The order, amending an earlier Executive order,[271] requires agency heads to close portions of the public lands to off-road vehicles if they will cause or are causing considerable adverse effects on the soil, vegetation, or other values. Further, it authorizes closing portions of the public lands to ORV's pending completion of studies and permanent designation of suitability for use by off-road vehicles.

WILDLIFE

Whales

Since 1972, the United States has sought a moratorium on the commercial killing of whales. Largely because of U.S. efforts, member countries of the International Whaling Commission have agreed to forbid all commercial killing of certain species and have reduced quotas on the total number of whales that may be killed by over 60 percent since 1972. The total quotas for the 1977–78 whaling season is 17,839, including Fin, Minke, Sei, Bryde's, and Sperm Whales.[272]

At the 29th meeting of the IWC in 1977, member countries agreed to a cutback of 10,211 whales for the 1977 quota, complete protection of Bowhead Whales (taken for subsistence by Alaskan natives), procedures for examining proposed kills of whales for scientific purposes, and new quotas to include all species of large whales, including Minke and Bryde's Whale previously taken without international regulation.

Several major issues addressed at the meeting remain unresolved. A U.S. proposal to prohibit the sale or transfer of whaling equipment to countries not members of IWC failed to pass. Responsibility for the management of small as well as large whales has not yet been accepted although the Commission did request statistics on kills of small whales from member nations. Some IWC member countries, particularly Japan, continue to buy whale products, such as meat and oil, from nonmember whaling nations, an action that seems to undermine attempts to bring all whaling nations into the IWC, and encourage whaling above the total sustainable quotas recommended by the Scientific Committee of the IWC.

Several nonmember countries—the Republic of Somalia, South Korea, Spain, Portugal, Chile, and Peru—take over 10 percent of the total number of whales killed each year. Efforts to encourage these countries to join IWC have not succeeded, but one nonwhaling nation, the Netherlands, rejoined the IWC in 1977, bringing membership to 16.

In spite of the progress made in the past 6 years in the IWC, a major change in the International Whaling Convention itself is

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needed before conservation measures will be adequate to assure protection. Member countries will meet in 1978 to complete a final negotiating text for a new international convention.

The Endangered Species Convention

Twenty-four nations attended the first meeting of the parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora held in Switzerland in 1976. Thirty-five nations have now ratified the Convention, which was negotiated in Washington, D.C., in 1973. The Conference added 46 animal and 2 plant groups to its protected list (Appendix I), for which import and export permits are required and trade is allowed only in exceptional circumstances; 61 animal and 10 plant groups were added to the regulated list (Appendix II), for which only export permits are required for monitoring purposes. Sea turtles and pythons were among the many species placed on the protected list. All primates were added to Appendix II. Of particular interest is the addition of all cat species to Appendix II, including the Bobcat and Lynx, which are being harvested at an increasing rate in this country. Export of U.S. Bobcat skins will now require federal export permits. The same requirement was adopted for the wolf, otter, and lynx. Monitoring of the export permits will provide information on the number and destination of U.S. skins and live animals.[273]

Federal export permits should help to protect the endangered Bobcat.

Critical Habitat

In two much-publicized cases last year, plans to build dams came into conflict with endangered animals and plants. The Endangered Species Act of 1973 requires identification and protection of habitat that is critical to continued existence of endangered species. In Tennessee, the Tellico Dam was halted by court order because it would destroy the last available habitat for the Snail Darter, a small freshwater fish.[274] An endangered flower, the Furbish Lousewort, was found within the impoundment area of the proposed Dickey-Lincoln reservoir in Maine.[275]

These two cases dramatize a complex wildlife management problem—when short-term benefits from human activity conflict with the long-term value of genetic diversity. The publicity on the Snail Darter and the Furbish Lousewort led some people to conclude that the Endangered Species Act should be amended so that projects already underway may be completed. But there have not been many conflicts arising from the law. The Office of Endangered Species, U.S. Fish and Wildlife Service, reports that less than 1 percent of endangered species consultations under the law result in court actions. Nearly 4,500 consultations have been resolved through administrative procedures, and so far only 3 critical habitat cases have reached the courts.[276] The critical habitat maps now being published by the U.S. Fish and Wildlife Service will help planners avoid most endangered species conflicts in the future.

WILDERNESS

When the National Wilderness Preservation System was enacted in 1964, it contained 54 National Forest units and covered 9.3 million acres. Since June 1976, 34 Wilderness Areas comprising 1.7 million acres have been added—a banner year in which more acreage was added than in any 12 months since passage of the Wilderness Act.[277] The areas are listed in Table 16.

BLM was exempted from review of its land for wilderness value when the Wilderness Act was passed, but under the Federal Land Policy and Management Act of 1976, it must study the wilderness values of all lands over 5,000 acres and all roadless islands with wilderness characteristics and report to the Congress within 15 years.[278] Meanwhile, the areas must be so managed as not to impair their suitability for preservation as wilderness (although existing mining and grazing uses may continue). Best estimates are that approximately 90–120 million acres of BLM land are eligible for wilderness review.[279] Guidelines are currently being developed to aid field offices in evaluating possible wilderness areas.

Roadless and undeveloped National Forest areas were not scheduled for review under the 1964 Wilderness Act either. However, the Forest Service has reviewed them and selected 274 study areas out of

Table 16

Areas Added to the National Wilderness Preservation System in 1976

Wilderness	Agency	State	Public Law	Acreage
Agassiz	FWS	Minnesota	94–557	4,000
Alpine Lakes	FS	Washington	94–357	303,508
Badlands	NPS	South Dakota	94–567	64,250
Bandelier	NPS	New Mexico	94–567	23,267
Big Lake	FWS	Arkansas	94–557	2,600
Black Canyon of the Gunnison	NPS	Colorado	94–567	11,180
Chassahowitzka	FWS	Florida	94–557	23,360
Chiricahua	NPS	Arizona	94–567	9,440
Crab Orchard	FWS	Illinois	94–557	4,050
Eagles Nest	FS	Colorado	94–352	133,910
Fitzpatrick	FS	Wyoming	94–557	197,600
Fort Niobrara	FWS	Nebraska	94–557	4,635
Great Sand Dunes	NPS	Colorado	94–567	33,450
Haleakala	NPS	Hawaii	94–567	19,270
Hercules-Glades	FS	Missouri	94–557	12,315
Isle Royale	NPS	Michigan	94–567	131,880
J. N. "Ding" Darling	FWS	Florida	94–557	2,825
Joshua Tree	NPS	California	94–567	429,690
Kaiser	FS	California	94–557	22,500
Lacassine	FWS	Louisiana	94–557	3,300
Lake Woodruff	FWS	Florida	94–557	1,146
Medicine Lake	FWS	Montana	94–557	11,366
Mesa Verde	NPS	Colorado	94–567	8,100
Mingo	FWS	Missouri	94–557	8,000
Pinnacles	NPS	California	94–567	12,952
Point Reyes	NPS	California	94–567	25,370
Red Rock Lakes	FWS	Montana	94–557	32,350
Saguaro	NPS	Arizona	94–567	71,400
San Juan Islands	FWS	Washington	94–557	355
Shenandoah	NPS	Virginia	94–567	79,019
Simeonof	FWS	Alaska	94–557	25,141
Swanquarter	FWS	North Carolina	94–557	9,000
Tamarac	FWS	Minnesota	94–557	2,138
Ul Bend	FWS	Montana	94–557	20,890

Agency	Added 1976		Total	
	Areas	Acreage	Areas	Acreage
FS	5	669,833	92	12,605,405
NPS	13	919,268	17	1,120,213
FWS	16	155,156	52	718,087
Total	34	1,744,257	161	14,443,705

Source: P.L. 94–352, 90 Stat. 870, 16 U.S.C. 1132; P.L. 94–357, 90 Stat. 905, 16 U.S.C. 1132; P.L. 94–557, 90 Stat. 2633, 16 U.S.C. 1132; P.L. 94–567, 90 Stat. 2692, 16 U.S.C. 1132.

1,449 identified for wilderness characteristics.[280] The Department of Agriculture is now reviewing these lands to add areas overlooked in the 1973 roadless area review. It did not include some eastern National Forests or the National Grasslands. Action has begun in this session of Congress to establish more study areas and to designate other areas as wilderness immediately. The Administration has endorsed and in some cases expanded previously pending wilderness proposals and has supported study or wilderness designation of additional areas.[281]

Wilderness proposals have also been submitted for portions of four National Parks.[282]

WILD AND SCENIC RIVERS

The National Wild and Scenic Rivers System was established in 1968 [283] to protect a representative portion of our remaining free-flowing rivers from loss to dams or other obstructions and their immediate environment from unsuitable development. Eight rivers were included in the system and 27 others were to be studied to determine their suitability.

Three rivers totaling 425 miles were added to the System and one was mandated for study between June 1976 and May 1977. An omnibus bill passed in October [284] designated 219 miles of the Flathead and 159 miles of the Missouri, both in Montana, and 46 miles of the Obed in Tennessee as Wild and Scenic Rivers. The Housatonic in Connecticut will be studied.

There are now 19 rivers protected by the Wild and Scenic Rivers System, as shown in Table 17. An additional 51 rivers are either under study or have been studied and proposed. The Administration proposed that segments of 8 of the rivers be added to the System and that portions of 20 others be studied. Legislation to withdraw construction authority for the Cross Florida Barge Canal and to authorize study of the Oklawaha River for possible inclusion in the System [285] was proposed by the Administration.

A 15-year battle to save a section of the New River in North Carolina from hydroelectric dam development was finally decided in September 1976 when the New River was added to the Wild and Scenic Rivers System.[286] This action nullified an FPC license to build two dams and gave assurance that no dam would threaten this part of the river.

MINING AND MINERALS

Surface Mining

The Surface Mining Control and Reclamation Act of 1977 became law in August, establishing nationwide environmental control over strip mining.[287] It prohibits the damaging coal strip mining of the past and requires reclamation of the land after mining. Although it does not contain all the features sought by the Administration, it

Table 17

Components of the National Wild and Scenic Rivers System

River	Location	Administering agency	Miles by classification: Wild	Scenic	Recreational	Total miles	Status/Public Law
Middle Fork Clearwater	Idaho	FS	54	—	131	185	P.L. 90-542, 10/2/68
Eleven Point	Missouri	FS	—	44.4	—	44.4	P.L. 90-542, 10/2/68
Feather	California	FS	32.9	9.7	50.4	93	P.L. 90-542, 10/2/68
Rio Grande	New Mexico	BLM/FS	51.75	—	1	52.75	P.L. 90-542, 10/2/68
		(BLM)	(43.90)	—	(0.25)	(44.15)	
		(FS)	(7.85)	—	(.75)	(8.60)	P.L. 92-542, 10/2/68
Rogue	Oregon	BLM/FS	33	7.5	44	84.5	P.L. 92-542, 10/2/68
		(BLM)	(20)	—	(27)	(47)	
		(FS)	(13)	(7.5)	(17)	(37.5)	
St. Croix	Minnesota/Wisconsin	NPS/FS	—	181	19	200	P.L. 90-542, 10/2/68
Middle Fork Salmon	Idaho	FS	103	—	1	104	P.L. 90-542, 10/2/68
Wolf	Wisconsin	NPS	—	25	—	25	P.L. 90-542, 10/2/68
Allagash	Maine	State	95	—	—	95	Secretarial designation 7/19/70
Lower St. Croix	Minnesota/Wisconsin	NPS	—	12	15	27	P.L. 92-560, 10/25/72,
		Minnesota/ Wisconsin	—	—	25	25	Secretarial designation 6/17/76
Chattooga	North Carolina/South Carolina/Georgia	FS	39.8	2.5	14.6	56.9	P.L. 93-279, 5/10/74
Little Miami	Ohio	State	—	18	48	66	Secretarial designation 8/20/73
Little Beaver	Ohio	State	—	33	—	33	Secretarial designation 10/23/75
Snake	Idaho/Oregon	FS	32.5	34.4	—	66.9	P.L. 94-199, 12/31/75
Rapid	Idaho	FS	24	—	—	24	P.L. 94-199, 12/31/75
New	North Carolina	State	—	26.5	—	26.5	Secretarial designation 4/13/76
Missouri	Montana	BLM	72	18	59	149	P.L. 94-486, 10/12/76
Flathead	Montana	NPS/FS	97.9	40.7	80.4	219	P.L. 94-485, 10/12/76
Obed	Tennessee	NPS/State	45.2	—	—	45.2	P.L. 94-485, 10/12/76
Total			681.05	452.7	448.4	1,655.15	

Source: U.S. Department of the Interior, Bureau of Outdoor Recreation, "River Mileage Classifications for Components of the National Wild and Scenic Rivers System," 1977.

provides critically needed measures for protection of land and water.

The law permits mining on prime farmlands only if they can later be restored to their original productivity, forbids leaving high walls after mining except for some experimental purposes, and imposes an immediate ban on dumping spoil or overburden on slopes of more than 20 degrees. The last prohibition applies to large and small operators alike; some other provisions do not apply to small operators until January 1, 1979.

The Act offers considerable protection to the critical alluvial valley floors of the West. It generally prohibits mining that adversely affects agricultural uses in alluvial valleys or that damages water supply; however, the Act contains a number of exceptions to these prohibitions.

Mined-over areas must be returned to their approximate original contours, and a tax to be collected on currently produced coal will be used to reclaim the "orphaned" lands left from earlier days.

Overall, although in some respects the law falls short of President Carter's recommendations and lacks some features of the bills vetoed last year by President Ford, it offers good protection for the environment in connection with surface mining.

Responsibility for regulation is delegated to states demonstrating ability to enforce the environmental standards that the Act establishes. When states lack the capacity to do so, the Department of the Interior will enforce the standards.

Mining Law of 1872

Hard rock mining on public lands is still governed by the Mining Law of 1872. Its chief failings are that it does not provide for balanced use of the federal lands but allows mining to preempt other uses, it provides for conveyance of mineral lands out of federal ownership rather than for leasing them subject to rental and royalty payments, and it does not provide adequate control of environmental damage from mining on the public lands.

The President has directed the Department of the Interior to prepare legislation to replace the Mining Law of 1872 with a new law providing a discretionary leasing system for hard rock mining on public lands. Under the system, the Secretary of Interior would have discretion to balance mining with other uses when considering whether to lease lands. The legislation would provide strict standards for environmental protection and reclamation of mined areas and would establish royalties for hard rock mineral development on public lands.

Phosphates

Problems with the mining of phosphates in Florida, California, and southeastern Idaho remain unresolved. In the case of the

Osceola National Forest, studies of impacts on the hydrology and the endangered species of the area are slated for completion in December 1977. The Kerr-McGee Corporation has sued the Department of the Interior to force issuance of preference right leases by which it could proceed with development of the phosphates that it has discovered.[288] The government is appealing a district court order to issue the leases. The Interior Department has not yet decided whether to permit exploitation of phosphate deposits on the Los Padres National Forest, California, and expansion of phosphate production in the Caribou National Forest, Idaho.[289]

Mining in National Parks

The 94th Congress took a much needed step [290] to protect National Parks from new mining (discussed at length in our last Annual Report) in closing the six areas in the National Park System which were still open to mineral entry under the Mining Law of 1872. The areas are: Death Valley National Monument, California-Nevada; Glacier Bay National Monument, Alaska; Crater Lake National Park, Oregon; Organ Pipe Cactus National Monument, Arizona; Mount McKinley National Park, Alaska; and Coronado National Memorial, Arizona. No new mining venture may begin in these areas, and there is a 4-year moratorium on new surface disturbances on existing claims.[291]

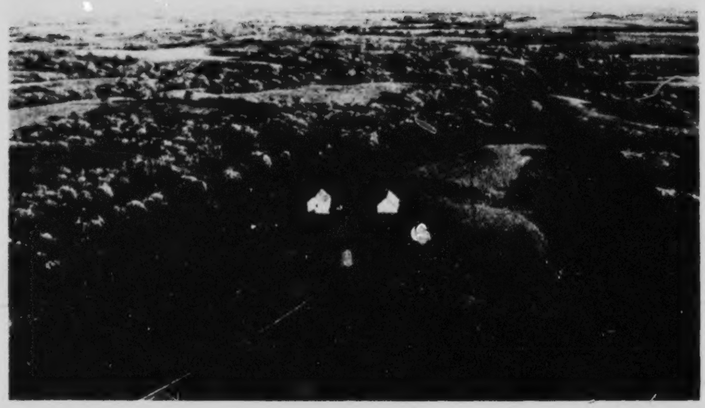
AGRICULTURE

Prime Farmland

More than 8 million acres of prime U.S. farmland was converted to urban development, reservoirs, and other uses from 1967 to 1975—an average net loss of 1 million acres per year. Losses in the southeast and Corn Belt regions were most severe, accounting for 3 of the 8 million acres.

These were among the findings of a report on prime farmlands prepared by the Agriculture Department's Soil Conservation Service at the request of the Council.[292] The SCS definition of prime farmland was based on soil quality, growing season, and moisture supply needed to produce sustained high crop yields using modern farm methods. The SCS estimates that there are about 384 million acres of prime farmland so defined in the United States, of which 65 percent, or 250 million acres, is now being cropped. Other uses—forest, pasture, and range—are summarized in Table 18.

Even though they are defined as prime farmlands, not all 134 million acres in uses other than cropland could easily be converted to crops. In fact, only 40 million acres could be converted without severe or insurmountable development problems, such as high potential for soil erosion or flooding. The greatest losses of prime farmlands are occurring in areas with minor environmental and management prob-



Millions of acres of prime farmland have been converted to urban development and other uses in the last several years.

Table 18

U.S. Prime Farmland Use[1]

Land use[2]	Prime farmland (million acres)	Prime farmland	
		Percent of total	Percent of noncropped
Cropland	250	65	0
Pasture and range	76	20	58
Forest	43	11	31
Other land	15	4	11
Total	384	100	100

[1] Nonfederal lands and federal cropland.

[2] Based on 1968 Conservation Needs Inventory definitions.

Source: U.S. Department of Agriculture, Soil Conservation Service, "Extent and Distribution of Prime Farmlands in the U.S.," draft, April 8, 1977.

lems; at the same time land with severe soil erosion and drainage problems is being brought under cultivation, sometimes with federal assistance.

In an effort to protect prime farmland and curb federal activity leading to losses, in June 1976 the Department of Agriculture urged all agencies to avoid taking prime agricultural land unless no suitable alternative exists.[293] We followed up by directing federal agencies to evaluate impacts on their actions on prime and unique farmlands in environmental impact statements (see Appendix E).[294] The Department of Agriculture is providing technical assistance for evaluations and is continuing to identify and map prime farmland in order to protect this essential natural resource.

Soil Erosion

Erosion of topsoil from farmlands is severe enough to threaten continued crop productivity despite federal expenditures for soil conservation of nearly $15 billion since the 1930's, according to a General Accounting Office report.[295]

GAO studied 283 farms randomly selected in the Great Plains, Corn Belt, and Pacific Northwest regions. Approximately 84 percent of these farms were losing over 5 tons of topsoil per acre from croplands each year; of these same 283 farms, some 25 percent were losing more than 20 tons per acre per year. In addition to direct crop losses, the eroded soil is causing air and water pollution and added highway maintenance costs. Other recent soil erosion studies suggest that U.S. farmers are losing more soil per acre through erosion today than they did 15 to 30 years ago.[296]

GAO was critical of Department of Agriculture soil conservation programs, in particular the Conservation Operations and the Great Plains Conservation Programs of the Soil Conservation Service and the Agricultural Conservation Program of the Agricultural Stabilization and Conservation Service. The report urged these agencies to seek out farmers with severe erosion problems and to ensure that the several hundred million dollars spent for soil conservation each year is better directed to conserving the nation's topsoil.[297]

The Water Resources Conservation Act of 1977, which has passed the Senate and is now before the House, calls for a soil and water resource inventory and program planning effort similar to that required of the Forest Service by the Resources Planning Act.[298] Other approaches to effective soil conservation are aggressive implementation of the nonpoint source pollution control program, through Section 208 of the 1972 Water Pollution Control Act, and making price supports, loans, crop insurance, etc., conditional to adoption and maintenance of adequate soil conservation measures.[299]

Irrigation Water Use

The Bureau of Reclamation, which delivers approximately 25 million acre feet of water annually to irrigate 9.3 million acres of land in the West, was also criticized by GAO. After reviewing the efficiency of irrigation in Bureau projects, GAO stated that "less than half of the water delivered to a farm for irrigation is productively used by the crops." [300]

This study of irrigation practices in four western states found that overirrigation limits crop production because it removes valuable nutrients from the soil. In Idaho, for example, irrigation raises farming costs by increasing pumping and drainage requirements and contributes to water pollution by washing topsoil, salts, and nutrients into streams and rivers.

Although the GAO study preceded the current severe drought, the report pointed out several benefits of better water conservation practices. It also emphasized the need for improvement in the Bureau's

Irrigation Management Services and suggested reexamination of federal water pricing policies to promote more efficient water use.

WATER RESOURCES

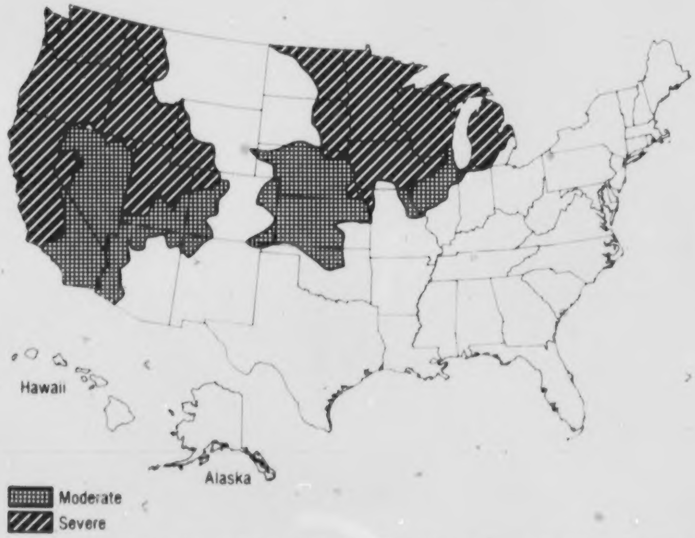
Drought

Throughout much of the West and parts of the Midwest, the major environmental event of the year was the drought. Drought conditions prevailed through the first part of 1977 (see Figure 8). Snowpack, usually a major source of streamflow in these areas during the spring and summer, was only 5 to 30 percent of normal in most of California and Nevada and parts of Idaho, Oregon, and Utah. Record low streamflows—10 to 40 percent of normal—were forecast for most rivers draining these areas (see Figure 9). By the end of May many reservoirs contained less than 40 percent of their normal maximum storage.[301]

Besides causing extensive crop and livestock losses, the drought caused other damage. Reduced streamflows restricted the normal spawning runs of anadromous fish such as salmon and steelhead, limited recreational use of rivers, lakes, and reservoirs, and lowered water quality because smaller volumes of surface water carried higher concentrations of irrigation return flows and sewage effluents.

Figure 8

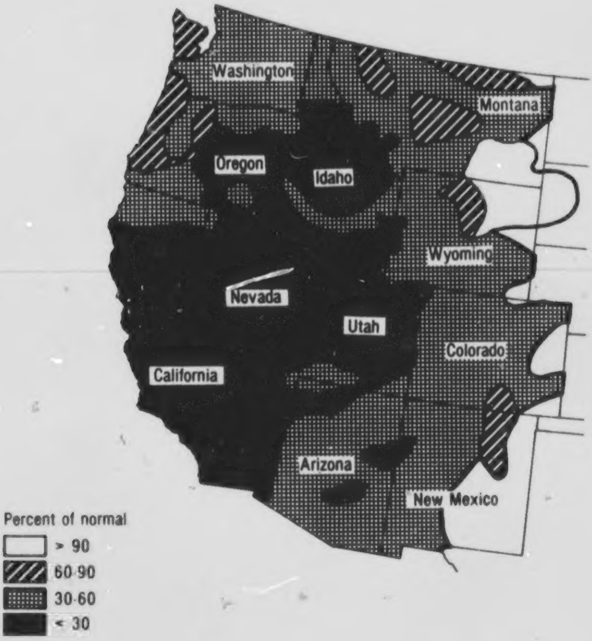
Drought, January 1 to April 30, 1977



Source: U.S. Water Resources Council, *Preliminary Water Resources Problem Statements* (Washington, D.C., 1977), p. 3.

Figure 9

Streamflow Forecast in the West, Spring 1977



Source: U.S. Department of Agriculture, press release, 1298–77, May 13, 1977.

As surface and ground water reserves declined, continued domestic and industrial use of water caused shortages, particularly in northern California where drought emergencies were declared.

In the Pacific Northwest, where cheap hydroelectric power normally meets over 80 percent of electricity demand, lower streamflows reduced electricity output, causing curtailed production and job layoffs in the energy-dependent aluminum industry. Utility companies are now seeking alternative power sources and are forecasting rate increases.

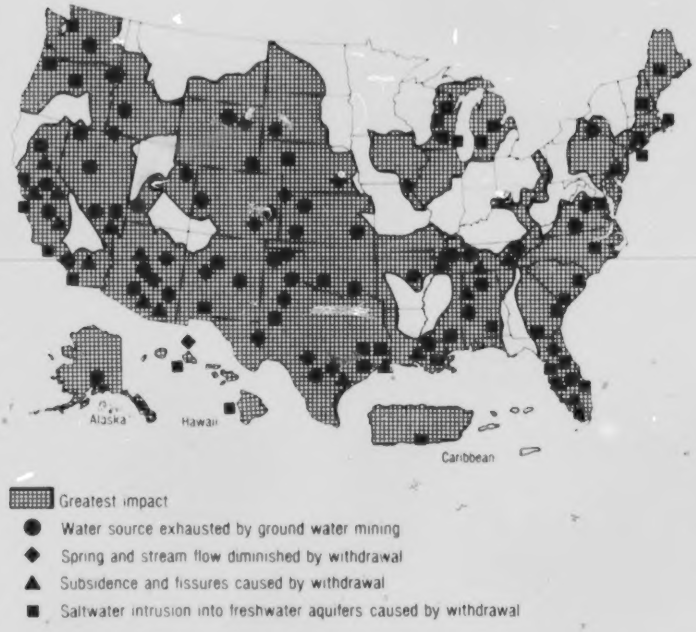
Dry and exposed soils combined with unusually strong winds led to severe soil erosion and dust storms not experienced since the 1930's in cultivated areas of Colorado, Kansas, and other states east of the Rocky Mountains and increased the hazard of forest and range fires.

Responses to the Drought

In the absence of a national water resource management policy the public and local governments devised their own response to water shortages. One was to tap additional underground reserves. Ground water, which provides one-fourth of the nation's freshwater,

Figure 10

Ground Water Depletion, 1975


Alaska
Hawaii
Caribbean
▨ Greatest impact
● Water source exhausted by ground water mining
◆ Spring and stream flow diminished by withdrawal
▲ Subsidence and fissures caused by withdrawal
■ Saltwater intrusion into freshwater aquifers caused by withdrawal

Source: U.S. Water Resources Council, *Preliminary Water Resources Problem Statements* (Washington, D.C., 1977), p. 11.

had already been seriously depleted in parts of the Midwest and Southwest, and is now being further mined or overdrawn for irrigation and municipal water supplies (see Figure 10). This depletion caused additional decline in water tables and streamflows in Arizona, Texas, Nebraska, and other Great Plains states, compounding the adverse impacts of the drought.[302] Although water experts have pointed out that further ground water depletion could have disastrous effects on these agricultural and municipal users, state and local regulation of ground water withdrawals is inadequate.

Faced with near-exhaustion of municipal water reserves, Marin County, California, instituted water rationing and a series of other compulsory water conservation measures. State and municipal authorities in other parts of the country, including the Dakotas and Washington, D.C., prepared similar contingency plans.

At the federal level, first responses to the drought were relief efforts—grants and loans to farmers, ranchers, and business people suffering direct losses from the drought in the Great Plains and western states.

On March 23 President Carter sent to the Congress a comprehensive $844 million proposal which requested temporary loan and grant authorities and supplemental funding to improve water supply systems, cover crop and livestock losses, and increase assistance for soil conservation, irrigation, and purchase of water and energy.[303] He also stressed the importance of encouraging water conservation through several existing programs. The Congress quickly enacted most elements of the President's proposal.[304] In April an interagency committee was established by the Secretaries of Agriculture, Interior, and Commerce and the Administrator of the Small Business Administration to designate areas eligible for drought-related federal assistance.

Although they provided much needed relief, most of these emergency measures did not address the broader problem of how to achieve better management of water as a limited natural resource.

In his Environmental Message in May the President called for "establishment of a national water resources management policy" with emphasis on economic efficiency, environmental protection, and water conservation.[305] In a speech to the National Conference on Water the following day, Secretary of Interior Andrus also emphasized water conservation and suggested some specific changes in federal programs such as establishment of water efficiency requirements for irrigation and other uses supported by federal funds. A federal task force on water conservation is preparing more detailed options and recommendations as part of a comprehensive review of water resources policy.[306]

Water Policy Reform

Soon after taking office, President Carter initiated a major interagency review of federal water resource projects and announced his intention to develop comprehensive water policy reforms and to oppose construction of projects which fail to meet minimum economic, environmental, and safety criteria.[307]

Approximately 325 active projects of the Corps of Engineers, Bureau of Reclamation, and Tennessee Valley Authority were screened; 32 were selected for public hearings and additional intensive review. In April the President recommended to the Congress that no federal funds be spent for 18 of the projects and that 5 undergo major modification in design and scope. The remaining 9 projects were proposed for fiscal year 1978 funding without modification.[308]

Among the projects which the President recommended for termination was the Corps of Engineers' Meramec Park Lake in Missouri, which would inundate 75 miles of Ozark streams, numerous scenic caves, and over 12,000 acres of farmland and forest land to provide flood control, flat water recreation, and water supplies. Federal costs for the project are estimated at more than $88 million. Others included the Bureau of Reclamation's Fruitland Mesa project in Colorado, which would require a federal investment of over $82 million to provide irrigation water to fewer than 70 landowners, and the Columbia Dam, a TVA project in Tennessee, which would flood 54 miles of free-flowing stream and destroy or degrade over 55,000 acres of farmland, forest, and upland habitat to subsidize regional development and recreation at a federal cost currently estimated at more than $110 million.

After much debate over these water project recommendations, the Congress and the President agreed to a compromise on the appropriation of funds for fiscal year 1978; in August the President signed an appropriation bill in which funding was deleted for nine projects, including the Meramec Park and Fruitland Mesa projects.[309] Three more were substantially modified, and 12 additional unbudgeted projects were dropped. Funding was included in the appropriation bill for 9 projects opposed by the Administration, including the Columbia Dam.

Project modifications include deletion of remaining river channelization at the Corps of Engineers' Tensas Basin project in Louisiana and major changes in the Bureau of Reclamation's Central Arizona Project, including the elimination of Orme Dam, which had been challenged on environmental and safety grounds.

Smaller projects of these agencies and Soil Conservation Service watershed projects are also being reviewed, but final recommendations have not yet been made.

This first phase of Administration efforts to reform water resource policy—the project review and recommended budget cuts—generated intense public comment, wide media coverage, and controversy within the Congress. At the direction of the President, the Water Resources Council, the Office of Management and Budget, and the Council on Environmental Quality are reviewing present water resource policy and are to deliver recommendations to him for policy coordination and reform by mid-February 1978.[310]

These agencies have focused on seven principal issues:

- Revision of water resource planning and evaluation criteria and procedures
- Cost sharing for federal projects
- Institutions and institutional arrangements
- Federal reserved water rights
- Water conservation
- Water quality
- Water resources research.

Study participants are making use of the information gathered at previous nationwide public hearings as well as existing analyses of federal water resource programs and policies, including documents of the National Water Commission and the Section 80 Study[311] (discussed in the 1975 and 1976 Annual Reports). The President is expected to announce his decision on these issues in the spring of 1978.

The Administration is also soliciting public comment and contributions to the developing water resource policy. Government officials and interested citizens discussed policy alternatives at the 1977 National Conference on Water sponsored by the Water Resources Council and several national nongovernment organizations.

Floodplain Management

Issued in conjunction with the Environmental Message, a new Executive order on Floodplain Management (reproduced in Appendix A) restricts federal executive agencies from undertaking, supporting, or allowing construction and other incompatible development in floodplains unless the agency makes a formal finding that no practicable alternative exists.[312] It replaces a 1966 order which lacked specific implementation provisions.[313] The new order requires federal agencies to manage their property and conduct their assistance and regulatory programs in accordance with standards similar to those set earlier for the National Flood Insurance Program.[314]

The goal is to reduce losses of life and property resulting from unwise development of floodplains but to allow uses compatible with periodic flooding—agriculture and forestry, recreation, and fish and wildlife habitat. Control over incompatible and hazardous uses will be more difficult if proposed amendments to the 1973 Flood Disaster Protection Act become law. The amendments would remove the Act's prohibition against federally supported loans for development in identified flood hazard areas. This prohibition is limited to flood hazard areas of comunities *not* participating in the national flood insurance program.

Wetlands Protection

Three related actions emphasize Administration concern for protecting the nation's coastal and inland wetlands. The first is an Executive order requiring all federal executive agencies to refrain from supporting construction in wetlands wherever there is a practicable alternative.[315] The order (reproduced in Appendix A) establishes a federal policy for the conservation and protection of wetlands and provides for public review of any agency plans or proposals to alter wetlands. The order does not apply to permits or licenses issued by federal agencies to private parties for activities on nonfederal property affecting wetlands.

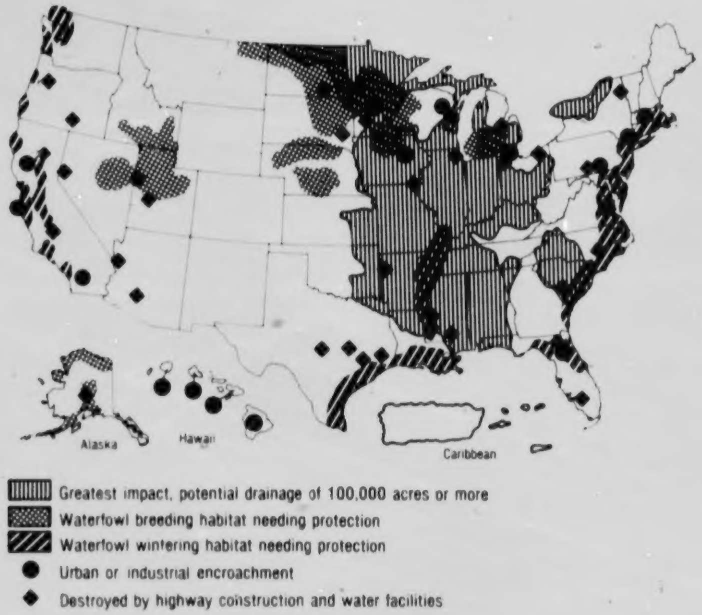
Second, the President stated Administration support for the existing federal program which regulates discharge of dredged and fill material in all U.S. waters and associated wetlands pursuant to Section 404 of the Federal Water Pollution Control Act of 1972.[316] The Administration proposed amendments to the Act authorizing the states to assume responsibility for carrying out major portions of the program.

Congressional interest in restriction of direct federal regulatory action affecting wetlands and delegation of control to the states increased as the program entered Phase III in July. In this phase the regulatory authority of the Corps of Engineers, which the law designates as the responsible federal agency, is extended to include the headwaters of navigable rivers and streams.

The third Administration action related to wetlands is a proposal for a 5-year budget increase of $50 million for acquisition of wetlands to maintain important breeding and wintering habitats for migratory waterfowl. The program, to be carried out by the Interior Department's Fish and Wildlife Service, will eventually be nationwide, but initial emphasis will be placed on acquiring important waterfowl breeding habitat in the prairie pothole country of the upper Midwest and in waterfowl wintering areas of Texas, Louisiana, and California (see Figure 11).

Figure 11

Wetland Wildlife Habitat Loss, 1955–75


Alaska
Hawaii
Caribbean
▥ Greatest impact, potential drainage of 100,000 acres or more
▩ Waterfowl breeding habitat needing protection
▨ Waterfowl wintering habitat needing protection
● Urban or industrial encroachment
◆ Destroyed by highway construction and water facilities

Source: U.S. Water Resources Council, *Preliminary Water Resources Problem Statements* (Washington, D.C., 1977), p. 33.

HUMAN SETTLEMENTS

Environmental concerns are not limited to air and water pollution or to protecting valuable natural resources. They also include protecting and enhancing the environment where most people live, from the smallest neighborhoods to the largest cities. Besides continuing efforts to control air pollution, water pollution, and noise, we must also improve the economic, cultural, recreational, and social stability and viability of our urban areas.

COMMUNITY IMPACT ASSISTANCE

Many problems of rapid growth that plagued cities and suburbs in the fifties and sixties are reappearing in small towns and rural settlements, especially where energy-based growth booms are occurring. Small coastal towns faced with development of oil and gas on the outer continental shelf, western communities near public lands rich in mineral resources, Appalachian towns experiencing renewed coal prosperity but with rundown physical plant from earlier boom days, and Illinois farming communities overlying extensive coal deposits are suddenly confronted with rapid population growth with which they cannot easily deal.

Often these communities do not have full-time public officials and administrators or the capital budgeting, planning, and land use control programs that their situations call for. With a rapid population influx, their housing, commercial facilities, and public services soon fall far short of growing community needs. The consequences may include unsafe or insufficient water supplies, scarce and high-priced housing, inadequate transportation, crowded schools, and strained medical, law enforcement, and fire protection services. Public concerns center on a deteriorating quality of life, uncertainty as to what, when, and where development will take place, and questions of who assumes the risk for public infrastructure investment. Communities which are unable to deal with the impacts pay a heavy price in social disruption, employee discontent, declines in productivity, increased costs of production and services, and wasteful use of resources.

Because new energy development is a national interest although its impacts are local or regional, the federal government has been asked to assume a larger share of the risk and responsibility for mitigating the adverse impacts of the development. New federal assistance bills passed by the 94th Congress are shown in Table 19.

For energy impacts in the coastal zone, the Congress amended the Coastal Zone Management Act of 1972.[317] The Coastal Energy Impact Program provides some funding for planning and environmental grants, but the bulk of the funding is for credit assistance in the form of loans and loan guarantees to the states for communities adversely affected by energy development and for formula grants to the states, to be determined by the amount of OCS related activity onshore in the state or in adjacent OCS waters.

The planning grants may be used to prepare for oncoming energy activity and its socioeconomic and environmental consequences. En-

Table 19

Funds Potentially Available to Impacted Communities, Fiscal Years 1977–79

(million dollars)

Law	1977	1978	1979
Coastal Energy Impact Program			
Credit	110	143	200
Formula grants	10	15	20
Planning grants	3.5	0	0
Environmental grants	1.5	0	0
Mineral Leasing Act	117	177	206
Organic Act [1]	37	38	45
Payments in Lieu of Taxes [2]	100	100	100

[1] Based on estimates of need for front-end assistance as determined by certain coal production levels. Ten years of prospective revenues would exceed $1 billion. No funds will be released in fiscal year 1977.

[2] Six states (California, Delaware, Massachusetts, New Jersey, New York, and Rhode Island) do not qualify for funds under the legislation.

Source: Memorandum from Joellyn Murphy, Office of Coastal Zone Management, National Oceanic and Atmospheric Administration, Department of Commerce, to OCZM staff, May 18, 1977; memorandum from Ted Heintz, Office of Program Development and Budget, Department of the Interior, to Joyce Kelly, May 19, 1977; memorandum from Rich Winnor, Office of Policy Analysis, Department of the Interior, to Joyce Kelly, December 3, 1976.

vironmental grants are for preventing, reducing, or repairing damage to valuable environmental or recreational resources when the party responsible for the damage cannot be identified or charged for the damage. Credit assistance is available to help finance new or improved public facilities and new or increased public services required because of new or expanded coastal energy development. Formula grants provide repayment assistance—refinancing, modification of terms, supplemental loans, or repayment grants—to the borrowing government when it cannot meet its credit obligations because revenues from the coastal energy activity prove inadequate. They may also be used for planning, for repairing environmental damage, or for new community services or facilities when loan funds are not available.

The 1976 amendments created a $1.2 billion, 10-year aid program for coastal energy impacts. The first year 40.7 percent will go to Alaska. Table 20 lists the major recipients.

Table 20

Estimated Major Recipients of Impact Assistance, Fiscal Year 1977[1]

(million dollars)

	Total funds	Alaska	Louisiana	California	Washington	Mid-Atlantic[2]	Texas	Colorado	Wyoming	New Mexico	Missouri	Utah	Arizona	Idaho	Nevada
Coastal Energy Impact Program															
Credit assistance	110	48.6	19.4	6.6	5.8	12.7	4.1								
Formula grants	10	1.2	5.5	.9		[3] .8	1.0								
Planning grants	3.5	.4	.1	.3	.2	.3	.2								
Environmental grants	1.5	.7	.3	.1	.1	.2	.1								
Mineral leasing	117	5.3	.2	8.0	[4] 0			[5] 12.2	42.6	31.4	5.6	6.8	.2	1.3	.9
Payments in lieu of taxes	100	4.3	.1	8.5	2.1		1.2	9.0	7.3	9.9	8.9	7.5	7.9	7.1	5.1
Total	342	60.4	25.6	24.4	8.2	14.0	6.6	21.2	4.99	41.3	14.5	14.3	8.1	8.4	6.0
Percent of total	100	17.7	7.4	7.1	2.3	4.0	1.9	6.1	14.6	12.1	4.2	4.2	2.4	2.5	1.7

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[1] Includes states receiving at least $5 million in total impact assistance, specifically includes states receiving $5 million or more under Payments in Lieu of, Mineral Leasing, and CEIP credit assistance, $0.5 million or more in CEIP formula grants; and $51,000 or more in CEIP environmental grants.

[2] Essentially New Jersey and Rhode Island.

[3] Impounded New Jersey funds will be released pending resolution of litigation regarding OCS lease sale #40.

[4] Less than $50,000.

[5] No oil shale receipts collected.

Source: Memorandum from Joellyn Murphy, Office of Coastal Zone Management, National Oceanic and Atmospheric Administration, Department of Commerce, to OCZM staff, May 18, 1977; memorandum from Theodore Heintz, Office of Program Development and Budget, Department of the Interior, to Joyce Kelly, May 19, 1977; memorandum from Richard Winnor, Office of Policy Analysis, Department of the Interior, to Joyce Kelly, Council on Environmental Quality, December 3, 1976.

There may be important changes in the Coastal Energy Impact Program. Members of Congress from coastal states involved with OCS development have expressed considerable dissatisfaction with restrictions in the law and regulations on the use of formula grants. Several bills have been proposed. Some would reword the Act to reduce or eliminate federal discretion over state use of formula grants; others would permit states to use formula grants without trying first to finance community improvements through the loan fund; still others would not limit impact assistance to effects of energy facilities that can be located only in the coastal zone.

The arguments for these changes are that they would simplify the complex law and regulations governing use of formula grants and would make funds more readily available to communities that need them. On the other hand, they would remove present safeguards against drawing unneeded and inappropriate energy development to the coastal zone and might in fact reward or encourage such development. It appeared in mid-1977 that the issue may soon be resolved in connection with amendments to the Outer Continental Shelf Lands Act.[318]

Under the Mineral Leasing Act of 1920,[319] the federal government shares with the states involved revenues from mineral development on the public lands onshore. The Federal Coal Leasing Amendments Act of 1975 [320] increased the state share of lease revenues and royalties from 37.5 to 50 percent and allowed states to use the funds in areas impacted by mineral development for planning, construction, and maintenance of public facilities and for improved public services. As Table 21 indicates, most of the funds are going to Colorado, Wyoming, and New Mexico.

Table 21

Estimated Mineral Leasing Receipts, Fiscal Years 1976–79

(million dollars)

State	1976 Actual	1977 Estimated	1978 Estimated	1979 Estimated
Colorado	34.5	[1] 12.2	[1] 18.2	21.4
Montana	4.5	5.6	8.7	11.3
New Mexico	25.6	31.4	46.2	54.7
Utah	5.5	6.8	10.0	12.9
Wyoming	34.8	42.6	64.1	74.7
Subtotal	104.9	98.6	147.2	175.0
Total receipts	119.6	116.8	174.2	205.9
Percent of total	88	84	85	85

[1] No oil shale receipts collected.

Source: Memorandum from Theodore Heintz, Office of Program Development and Budget, Department of the Interior, to Joyce Kelly, Council on Environmental Quality, May 19, 1977.

The Bureau of Land Management Organic Act of 1976[321] established a system of advancing the mineral leasing funds to states at an interest rate of 3 percent for 10 years. Many small communities which have no bond ratings and thus have to pay very high interest rates or which may simply be unable to get credit will be able to make the improvements necessitated by rapid growth.

The Act permits legislatures to offer these funds from federal leases even to communities which are not experiencing rapid growth, giving priority to those which are in social or economic difficulties. The system is yet to be implemented. No funds were available in fiscal year 1977.

The Local Government Units legislation of 1976[322]—better known as the "Payment in Lieu of Taxes" Act—provides federal funds to local governments on the basis of public land acreage in the locality. The funds may be used for any government purpose.

The rationale for the law, based in part on the findings of the Public Land Law Review Commission,[323] is that localities should be compensated for weakened tax bases due to large federal land holdings. In particular, the Act is intended to compensate for lands that are *not* in production. Because the Department of the Interior has not yet developed procedures, disbursements this year are uncertain. The Administration has recommended that $100 million be allotted on the basis of a complex formula related to population, payments authorized by other statutes, and tax status of federal lands acquired from local and state governments. Because this legislation overlies other federal payment programs, unsystematic differences in federal payments per acre remain.

Anticipated funding levels for all four programs are listed in Table 19. Table 20 shows that most of the Interior funds will go to five western states, Alaska will receive the largest share of coastal impact funds, and the western states and California will receive the largest payments in lieu of taxes.

Because these assistance efforts have been designed to meet specific impact needs and are based on geography, production, or ownership, there is no general uniform policy for compensating localities for their fiscal burdens. The programs do not respond directly—sometimes they do not respond at all—to jurisdictional mismatch (revenues may benefit the community which is not suffering the impacts), differential taxation, housing availability, uncertainty of annual federal funding, or accessibility to funds by the community most in need.

Some states are developing their own programs. Montana's high state severence taxes on coal will finance local communities. Wyoming has created a Community Development Authority and Industrial Siting Council. The North Dakota Legislature is considering state revenue sharing and county income taxes to help jurisdictions with impact problems. It is still too early to determine how effective these programs will be.

COMMUNITY REVITALIZATION

While new programs were getting underway to help communities deal with rapid growth, other efforts were directed to conserving and revitalizing communities and neighborhoods that are in a state of decline. Some of the efforts enlarged or partially redirected existing programs. Others took the form of provisions in new laws whose main focus was often quite different. No massive community conservation program has been established, but many of the necessary ingredients already exist, and if coordinated, could add up to a fairly comprehensive program.

Most of the community revitalization funds come from the Department of Housing and Urban Development Community Development Block Grant Program, which granted over $5.5 billion to some 4,500 communities in 1975 and 1976.[324] Further, state and local initiatives to use existing housing stock and incentives for public and private investment in neighborhood preservation are encouraged by HUD's Innovative Projects Program.[325] In 1976 it allocated $4 million for 22 demonstration projects, including improved building and housing codes, joint public-private investments, and rapid acquisition and disposition of abandoned properties.[326]

Old buildings continue to be torn down, but some are being saved as available funds create incentives for revitalizing cities.

Measures to counteract disinvestment in potentially sound but endangered neighborhoods have been effectively demonstrated by the Urban Reinvestment Task Force, jointly funded by HUD and the Federal Home Loan Bank Board. It provides revolving loan funds, technical assistance, and other financial aid to partnerships of local residents, financial institutions, and local governments with promising strategies to arrest early neighborhood decline. HUD increased support from $2.5 million in fiscal year 1976 to $4.5 million in 1977 so that Task Force programs can be expanded from 30 to 55 cities.

The urban homesteading program hopes to attract young, energetic people back to the central city where through hard work—"sweat equity"—they will rebuild homes and thus rebuild the city.

The Supplemental Housing Authorization Act of 1977[327] created the National Commission on Neighborhoods with 4 members of Congress and 16 nongovernment members to be appointed by the President. The Commission will make recommendations to preserve and rebuild neighborhoods of diverse character and will encourage more effective community participation for such goals.

Preservation of valuable historic buildings, neighborhoods, and even entire towns is essential to attractive and livable communities, and they are a source of pride to their residents. New laws—the Tax Reform Act of 1976,[328] the Public Buildings Cooperative Use Act,[329] and provisions in several others—provide for neighborhood conservation.

The Internal Revenue Code's long-time bias against preserving historic buildings was largely corrected by the Tax Reform Act of 1976. Tax laws had always favored demolition of older buildings for replacement with newer ones. The Act eliminates accelerated depreciation for new buildings erected on the sites of demolished historic buildings and the right to deduct the cost of demolishing any registered historic structure. In addition, it permits an accelerated 5-year tax writeoff of the costs of rehabilitating a historic structure for business.

Each year the federal government spends approximately $1 billion to erect new buildings and about half as much more to lease property. The 1976 Public Buildings Cooperative Use Act, recognizing that federal buildings can affect their surrounding environment, encourages maximum use of buildings of historic or architectural significance. The Act also encourages use of space in or near public buildings for cultural, educational, and recreational activities, thus contributing to the vitality of the city and especially to the neighborhoods of which they are a part.

The old Post Office Building in Washington, D.C., is to be used by cultural agencies, and space on the ground floor may be leased for nongovernment use. In Savannah, the federal government is considering either of two historic properties—one a 19th-century railway complex, the other a 65-year-old hotel—for office space instead of building new offices.

After 15 years of planning and stop-and-go support, the Congress appropriated an initial $29 million to revitalize Pennsylvania Avenue in Washington, D.C.[330] Trees are to be planted, fountains installed, sidewalks widened, historic buildings such as the Beaux Arts Willard

Hotel restored to active use, and new housing and shops located near public plazas within sight of the White House. Eventually a proposed $130 million commitment is expected to generate $400–500 million in private investments in the area.

Several other laws promote historic preservation and neighborhood revitalization. The Railroad Revitalization and Regulatory Reform Act of 1976 [331] encourages the establishment of Amtrak passenger stations in historic and architecturally significant buildings. The Amtrak Act [332] had authorized funds to create new uses for valuable old railroad stations and had established programs to convert abandoned railroad rights-of-way to recreational and conservation uses.

The Arts, Humanities, and Cultural Affairs Act of 1976 [333] strengthens federal support for inventories of historic properties and supports scholarly works related closely to historic locales. Similarly, grants from the National Endowment for the Arts have been used to improve awareness of our national architectural heritage and to initiate neighborhood conservation projects. Under its Livable Cities Category, the Endowment makes grants to promote design excellence in community programs which join public and private efforts for projects of significant long-term community enhancement.

Greater support for state surveys of historic resources was provided by the 1976 amendments to the Land and Water Conservation Act of 1966,[334] which also established the Advisory Council on Historic Preservation as an independent agency. Table 22 lists the state grants for historic preservation in fiscal year 1977.

The Public Works Employment Act of 1976,[335] amended in 1977,[336] will create an estimated 280,000 jobs for rehabilitating, restoring, and building schools, hospitals, railroad beds, parks, industrial sites, and other public works projects such as water lines and sewage facilities. The Administration's economic recovery package also includes a youth employment and training program, which funds neighborhood and community improvements and restoration and maintenance of natural resources on public lands. Within the $1 billion appropriation of the Youth Employment and Demonstration Projects Act of 1977,[337] $115 million is available to the Youth Community Conservation and Improvement Projects to create jobs for youths from low-income families to rebuild and beautify their own neighborhoods.

LAND USE PLANNING

Although the impetus for comprehensive national land use planning legislation has diminished, interest continues in improving existing planning programs. Over two dozen federal programs presently provide planning funds to state and local governments and regional agencies for highways and public transportation facilities, air and water quality, waste disposal, community development and social services, parks and open spaces, schools, and cultural facilities. Estimated federal funding for such programs in fiscal year 1975 ranged

Table 22

Historic Preservation Grants, Fiscal Year 1977

(dollars)

State	Amount apportioned
Alabama	309,230
Alaska	172,442
Arizona	145,426
Arkansas	249,860
California	525,000
Colorado	279,246
Connecticut	463,893
Delaware	187,735
District of Columbia	200,277
Florida	199,006
Georgia	264,705
Guam	59,239
Hawaii	217,916
Idaho	146,067
Illinois	284,642
Indiana	154,163
Iowa	217,741
Kansas	141,666
Kentucky	343,391
Louisiana	179,402
Maine	188,045
Maryland	405,418
Massachusetts	525,000
Michigan	302,680
Minnesota	393,614
Mississippi	153,047
Missouri	404,173
Montana	166,431
Nebraska	187,758
Nevada	145,783
New Hampshire	158,125
New Jersey	221,083
New Mexico	155,088
New York	525,000
North Carolina	350,075
North Dakota	136,112
Ohio	378,918
Oklahoma	163,749
Oregon	164,998
Pennsylvania	469,024
Puerto Rico	157,103
Rhode Island	288,290
South Carolina	314,327
South Dakota	173,720
Tennessee	177,888
Texas	525,000
Utah	136,647
Vermont	194,998
Virginia	214,988
Virgin Islands	329,867
Washington	220,874
West Virginia	333,675
Wisconsin	174,478
Wyoming	181,676
Trust Territory	141,874
State and territory grants	13,923,600
National Trust grants	2,544,500
Total	16,468,100
Administrative expenses	1,031,900
Appropriation	17,500,000
Authorization	24,400,000

Source: National Register of Historic Places, National Park Service.

from $350 million to $560 million. These programs have the potential for affecting 442 individual federal grant programs, representing $45.6 billion annually.[338]

The need to coordinate these planning efforts at all levels of government has long been apparent, and the new Administration supports legislation directed to this need.

HUD, whose 701 Comprehensive Planning Program is funded at $57 million for fiscal year 1978, strongly encourages communities to integrate their Housing Assistance Plans into their comprehensive planning and also to integrate other planning efforts such as Coastal Zone Management, Water Quality Management Planning,[339] Economic Development Planning,[340] and Park and Recreation Planning [341] with the 701 plans.

Denver is an example of this integration. An areawide environmental impact statement for the Denver metropolitan area is being prepared with assistance from the 701 Planning Program under the

Rehabilitation of communities through restoration of buildings, jobs for youths, and other public works projects is essential to improving inner city neighborhoods.

direction of the Denver Regional Council of Governments.[342] The EIS is evaluating regional growth impacts on air and water quality, sewage and solid waste disposal, and social needs, for example. This type of areawide analysis may replace the individual environmental impact statements currently required for housing of over 500 units.

HUD has recently completed a similar effort in New Castle County, Delaware,[343] and is considering an areawide impact statement for Minneapolis-St. Paul in cooperation with the Twin Cities Metropolitan Council.

COASTAL ZONE PLANNING

So far coastal zone management programs have been approved for two states, Washington and Oregon, and two smaller units, the Bay Conservation and Development Commission of the San Francisco Bay area and the Culebra area of Puerto Rico. Approval of the California and Virgin Islands programs is expected by the end of the fiscal year. Nine more states are at the point of submitting draft programs: Maine, Massachusetts, Rhode Island, Maryland, North Carolina, Michigan, Illinois, Wisconsin, and Hawaii.

All but 1 of 30 coastal states and 3 of 4 territories are participating in the program. Indiana, suspended for failure to make progress in planning a program, has applied for reinstatement and approval is expected.

As states complete their coastal zone management plans, interpretation of the federal consistency provision of the Coastal Zone Management Act[344] becomes the subject of rigorous debate. This key provision of the law requires federal agencies to make their activities consistent, to the maximum extent practicable, with state programs once they are approved by the Secretary of Commerce. Further, federal agencies may not grant permits to private parties for activities in the coastal zone unless the activities have been certified by the states as consistent with their management programs.

Opinions differ on what federal activities are covered by the consistency provision. Federal lands themselves are exempt from the law, but if activities on federal lands cause secondary effects elsewhere—on lands and water that the program does cover—must the activities be consistent with a state program? The question is especially important in western states where much of the land is federally owned. Another question is how significant federal activities (and federally permitted activities) must be before the consistency provision applies. Of particular interest as the OCS is developed in frontier areas are the kinds of onshore facilities that must be submitted to the states for certification for consistency.

States and environmental organizations generally insisted on broad definitions covering as much as possible under the consistency umbrella; federal agencies sought to define the terms more narrowly. The Office of Coastal Zone Management in the Department of Commerce played a mediating role, and by midyear 1977 agreement on most important points appeared near.[345]

Another difference arose over the extent to which state programs should specify what kinds of development may take place in the coastal zone and where. In particular, the oil and gas industry criticized California's draft program on the grounds that it offered only principles and guidance to local governments, which make the land use decisions, subject to state approval. The industry argued that California had not provided for energy facility siting although the law expressly requires that such uses be considered; California could use the consistency provision to frustrate energy development if the federal government accepted a program that fails to "define the use of so much as an acre of ground." [346]

On the other hand, states have authority over land use in any case, and the Coastal Zone Management Act is intended to provide for federal, state, and local cooperation in controlling coastal uses of land and water—not for federal preemption of state authority. So long as state management programs contain procedures for considering all important interests in the coastal zone, including procedures to consult with federal agencies when national interests and federal laws are in question, the fundamental objective of the law will be satisfied. Further, consistency with state programs can be set aside under the Act when there is an overriding national interest.

TRANSPORTATION

Transportation is recognized as an important influence on the development of urban areas as well as on major elements of our energy conservation program. Two transportation bills enacted in the last year indicate a decreased emphasis on the private automobile.

The Federal-Aid Highway Act of 1976[347] provides increased flexibility in the interstate transfer provision of the 1973 Act.[348] It is now possible for localities to withdraw nonessential links from the Interstate Highway network and to use the funds for a mix of mass transit and local roads as determined by local officials. Mass transit funds available under the Act are supplementary to, not a substitute for, funds authorized and available under the Urban Mass Transportation Act.[349] Since 1974, five metropolitan regions—Boston, Hartford, Philadelphia, Washington, and Portland, Oregon—have shifted a total of $2.5 billion in federal commitments from interstate highway construction to mass transit. The 1976 Act authorized additional funding for bikeways, pedestrian walkways, rest and recreation areas, and land adjacent to federal aid highways necessary for the restoration, preservation, and enhancement of scenic beauty.

The second major law, the Railroad Revitalization and Regulatory Reform Act of 1976, provides $6 billion for improvement of the nation's railroads, of which $2.1 billion goes to Conrail, the corporation formed to rescue the bankrupt railroads of the Northeast and Midwest, to assist in operation of freight transport properties and some commuter runs. Federal assistance to enable states to pick up and maintain abandoned lines outside the Northeast and Midwest is funded at $1.6 billion. Improvement of intercity rail passenger service in the northeast corridor is funded at $1.75 billion. Track and roadbed improvement, enhancement, and other improvements are expected to reduce the travel time between Boston and New York City from 4 hours and 30 minutes to 3 hours and 40 minutes and from New York City to Washington from 3 hours and 50 minutes to 2 hours and 40 minutes. The Act also provides $360 million in subsidies for continued service of abandoned branch lines and $125 million for commuter services.

THE GLOBAL ENVIRONMENT

Because environmental degradation does not respect national borders, protection of our planet's biosphere requires the wide-ranging cooperative efforts of many nations. The need is evident for multinational assessment of environmental problems, regulation of polluting activities, and restitution to victims of environmental damage.

OCEANS

Nowhere is the need for global action more plain than in the management of ocean resources and the control of ocean pollution. Efforts to resolve these difficult issues in the Third U.N. Conference on the Law of the Sea, begun in 1973, continue as 150 nations negotiate additions or changes to existing international law. Preliminary agreement has been reached on the following: territorial seas shall extend no farther than 12 miles offshore, coastal nations' economic zones may extend as far as 200 miles offshore, and global cooperation is required for the conservation of highly migratory species of fish. Acceptable compromises between developed and developing countries have not been reached on international exploitation of deep seabed mineral resources, the right of coastal nations to restrict scientific research within their economic zones, and the legal status of the economic zone.

Fisheries

Because of delays in reaching new international agreement on exploitation of the ocean's living resources, 50 coastal nations have unilaterally declared national fishery or economic zones extending offshore as far as 200 miles, and in some cases beyond to the extent of their continental shelves. The Fishery Conservation and Management Act of 1976 [350] became fully effective March 1, 1977, and the U.S. government began enforcing it on that date. The Act provides for the setting of fish catch quotas by species on the basis of an ecologically sound optimal yield in order to rebuild and sustain these valuable food stocks. President Carter used the Act's authority over marine mammals to prohibit commercial whaling within our 200-mile zone. (For a discussion of international efforts to control whaling, see the section on wildlife in this chapter.)

Oil Spills

The series of oil spills off U.S. coasts in the winter of 1976–77 dramatized the threat from tanker-caused oil pollution to our marine and coastal environments. In March the President announced a series of initiatives to be taken by the federal government, including national and international actions.[351] Committees and working groups of the U.N. InterGovernmental Maritime Consultative Organization have taken up the Presidential proposals for improved construction and equipment features, including segregated ballast and inert gas systems for all tankers over a minimum size and double bottoms for new ones, improved inspection and enforcement of pollution laws against substandard vessels, and better training and standards for crews. These matters will be considered at specially scheduled sessions of IMCO committees throughout 1977 and the first part of 1978. (See the earlier section on energy for details.)

Land-Based Pollution and Ocean Dumping

Concern continues over the runoff from land into the oceans—the sewage, oil, fertilizers and pesticides, and many other complex, persistent, toxic manmade chemicals. There is encouraging progress here. The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter entered into force in August 1975 and now has been adhered to by 34 nations. As the result of a United

Nations Environment Program initiative, the Mediterranean littoral states signed the Convention for the Protection of the Mediterranean Sea Against Pollution, including resolutions on ocean dumping, in February 1976. These Mediterranean states are now discussing land-based pollution affecting their common sea. Some efforts are also being made in the Baltic Sea and the Persian or Arab Gulf, which suffer heavily from pollution, but much remains to be done.

ANTARCTICA

A growing population and rising demands for food have resulted in exploration and early exploitation of living resources all over the earth, even to inhospitable Antarctica. Exploratory fishing has begun for krill, the tiny shrimp-life creatures that are the central element in the rich Antarctic marine food chain. Krill is the largest unexploited fishery on earth; the annual yield may be equal to or greater than that of all other fisheries combined—50–70 million metric tons per year.[352] Several nations, including the U.S.S.R., Japan, Poland, and West Germany, are investigating commercial harvesting. The United States and other parties to the Antarctic Treaty of 1959 have begun preliminary negotiations on international management of krill and other living resources of the Antarctic.

Because of its extreme weather, cold seas, and thick ice cover, Antarctica is now the only continent without active exploration of continental shelf oil and gas; nor is exploration expected in the near future. The United States and other parties to the Antarctic Treaty are discussing the mineral resources issue; our objective is that any future exploration and exploitation be compatible with preservation of the Antarctic environment.

GLOBAL AIR POLLUTION

Even the earth's uppermost air is not free from human effects. The vital ozone layer, which protects us from dangerous ultraviolet radiation, is being damaged by complex chemical reactions stemming from release of chlorofluorocarbons, and there may be other future effects of such human activities as increased use of nitrogen fertilizers. (Further discussion may be found in the air quality section, Chapter 2.)

Through U.S. initiative two international meetings on the ozone layer were convened during the spring of 1977. The first, sponsored by UNEP, identified priority needs for research and monitoring and established an international program to fill the gaps. The second, called by the U.S. regulatory agencies—the Environmental Protection Agency, the Food and Drug Administration, and the Consumer Product Safety Commission—discussed planned U.S. regulation of fluorocarbons. Producer-user nations discussed other possible actions to reduce chlorofluorocarbon emissions, noting broad consensus on the seriousness of the problem. The Organization for Economic Cooperation and Development and the World Meteorological Organization are also working on the fluorocarbon problem.

Transfrontier air pollution is a much studied issue in Europe. In 1977, the OECD completed its study on the long-range transport of sulfur which demonstrated the cross-frontier character of the problem and the fact that individual national control programs can achieve only limited resolution of this problem.[353] The Economic Commission for Europe is planning a major multiyear project to analyze both the chemistry and meteorology affecting long-range transport of pollution; the United States and Canada will also take part, and further support may come from other parts of the world. (See the air quality section, Chapter 2, for extended discussion of acid precipitation.)

ENVIRONMENTAL IMPACT ASSESSMENT

Experience has led many countries to study and sometimes to adopt elements of our environmental assessment and impact statement processes. The industrially developed nations, east and west, are sharply conscious of the interrelationship of economic and environmental concerns and are exchanging information and developing guidelines for environmental impact assessment through several international organizations. UNEP has included in its goals for 1982 tested methods for governments and international organizations to integrate environmental concerns in development planning.[354] Awareness of the need for joint environmental assessment mechanisms is growing, but, for example, despite the close environmental relationship between the United States and Canada, we have not yet established such a mechanism.

TOXIC SUBSTANCES CONTROL

Coverage of the Toxic Substances Control Act of 1976 extends to importation of chemicals. International trade in chemicals is heavy, and only by sensitive regulation can we protect public health and the environment while avoiding unnecessary impacts on international trade.

The United States is working within OECD and bilaterally to harmonize international regulation of toxic substances. The volume of international trade and the global dangers posed are ample reason for considering development of an international convention to deal with these problems. In May 1977, UNEP urged nations not to permit the export of potentially harmful chemicals that are unacceptable domestically without the knowledge and consent of authorities in the importing country.[355]

ENVIRONMENTAL DEGRADATION IN DEVELOPING COUNTRIES

Recognizing that hunger, overpopulation, disease, poor soil use, and related problems are the basic causes of environmental degradation in most developing countries, President Carter instructed all officials concerned with development assistance to ensure that environmental soundness is integral to their consideration of projects. Further, he called upon the Agency for International Development to offer training and technical and financial assistance in environmental and natural resources management to developing countries independent of the source of their development funding.[356] In amending the Foreign Assistance Act,[357] the Congress directed AID to consider environmental protection assistance one of its highest priorities. In fact, AID has made considerable progress in bringing the environment into its project and program decisionmaking, especially relating to pesticides.

As a component of the nuclear nonproliferation policy of the United States, the President instructed agencies to provide assistance with nonnuclear energy alternatives to developing countries—the assistance to include consideration of environmental impacts in developing new energy sources.[358]

WORLD WATER PROBLEMS

During 1977 the United Nations sponsored two world conferences on related subjects—serious water shortages and poor water quality at the Water Conference in Mar del Plata, Argentina, and expansion of desert as a result of human activities at the Desertification Conference in Nairobi, Kenya. The Water Conference agreed that the world will be faced with increasingly serious economic, social, and political problems unless timely measures are taken to conserve and manage the fixed supply of water, that priority should be given to providing safe drinking water and sanitation for the yet unserved rural poor, and that measures must be developed to help prevent conflicts over water resources shared by two or more nations.

The Desertification Conference considered encroachment of deserts upon formerly arable lands and human impacts upon the process, including excessive human settlement in fragile resource areas, poor agriculture and grazing practices, and widespread destruction of forests and mountain watershed areas.

PRESERVATION EFFORTS

Many nations have recognized that unique natural and cultural sites and wildlife and their habitats are in danger from human activities and have ratified conventions to protect these irreplaceable assets. Signatories of the World Heritage Trust Convention of 1972, now ratified by 28 nations, met in June and July to agree upon criteria for inclusion of potential sites on national lists.

The 1940 Convention for Nature Protection and Wildlife Preservation in the Western Hemisphere and the Endangered Species Convention of 1973, discussed in an earlier section on wildlife, are proceeding toward full implementation. The Convention between the United States and the Soviet Union Concerning Conservation of Migratory Birds and Their Environment was signed at Moscow in November 1976. The United States also ratified the Conventions on Conservation of Polar Bears and of Antarctic Seals and a protocol extending the Convention of North Pacific Fur Seals.

ENVIRONMENTAL EDUCATION

Many people in urban, industrial countries are unaware of the environmental consequences of their actions. For many more in the developing countries, there seems no alternative in their day-to-day struggle for survival to consuming whatever resources are available, regardless of long-term ecological damage. Education cannot resolve all the conflicts between the desperate immediate needs for productive land, food, and fuel and the needs for sustaining the environment on which all of these resources depend. Yet there are viable choices to be made—between more and less acceptable ways of meeting urgent human needs, between development that works with nature and conserves resources and that which degrades and destroys the environment.

In October 1977 the U.N. Education, Scientific, and Cultural Organization, with UNEP assistance, sponsored a ministerial-level World Conference on Environmental Education in Tbilisi, Georgia, in the Soviet Union. Preparations included the International Environmental Education Workshop at Belgrade in 1975 and meetings in the six UNESCO geographic regions in 1976 and 1977. The main purpose of the Conference is to formulate recommendations for action at national, regional, and international levels for the promotion and development of environmental education.

NEPA

The National Environmental Policy Act received strong support and direction from the new Administration. In his Environmental Message, President Carter said that NEPA's effect had been dramatic and beneficial in the 7 years since its passage, but he also emphasized the need to reduce the paperwork and increase the usefulness of environmental impact statements.[359] In a new Executive order he directed CEQ to issue regulations, binding on all federal agencies, to implement NEPA and guide the EIS process (see Appendix A).[360]

Until now, agencies have developed their EIS procedures in accordance with CEQ guidelines (see Appendix H) issued under an earlier Executive order.[361] The regulations are expected to be a refined, improved, uniform, and legally binding step forward from the guidelines.

NEPA IMPROVEMENTS

In drafting new regulations and taking other steps to improve NEPA, the Council sought the views of concerned individuals, organizations, and public officials. Fifty witnesses testified at public hearings on June 6-8, 1977, before some 500 people, and many written comments were submitted.

Problem areas identified by the Council included how to focus on real issues and alternatives and make impact statements more useful to decisionmakers and the public; how to streamline the process and to eliminate conflicts, duplication, and paper production; and how to emphasize substance over procedure and implement NEPA's purpose—protecting the quality of our environment.

The hearings evinced a widespread consensus about the value and goals of NEPA and the environmental impact statement process. Few witnesses advocated amending NEPA, and many specifically noted that no legislative changes were needed to accomplish reform. One U.S. Senator testifying at the hearings commented:

> It is very interesting to me to note the strong support for the NEPA process and the need expressed for such impact statements. A few years ago I do not think we would have got that. But now we are seeing that in the responses from the various people I contacted. Their comments are made only as suggestions on how to improve the existing system.[362]

Many witnesses, representing many points of view and interests, made these points:

- EIS's should be shorter, should concentrate on key options, and should contain a brief summary highlighting the issues.
- EIS's should be prepared during the planning of agency actions and should be issued prior to agency decisions.
- NEPA analysis should include economic impacts and impacts of U.S. actions outside the United States.
- Broad-scale statements—geographic (areawide), program (basic agency policy), and generic (resource life cycle)—should be more widely used.
- Federal agencies should be more responsive to the views of state and local governments and concerned citizens.
- Ways to resolve disputes, short of going to court, should be provided.
- Overlapping state and federal impact statement requirements should be coordinated and streamlined.
- Environmental analyses should meet higher professional standards, including the use of attribution, peer review, and measures to avoid conflicts of interest.

- NEPA obligations should go beyond consideration of consequences and alternatives in EIS's and should address the substance of environmental protection; EIS's should identify the environmentally preferable option; mitigation measures should be announced and should be enforceable; agencies should monitor impacts.

Several witnesses, including representatives of states with laws similar to NEPA, cautioned the Council not to undermine the Act in an effort to simplify procedures and reduce paper production. The Director of the Commission on Federal Paperwork emphasized that

> the process of developing a draft EIS and generating discussion and evidence and more insightful analyses of the issues is an extremely important one and must be pursued . . . . We found the environmental impact statement process can be very important—it has been very important—but because of the conflicting requirements of the federal agencies and state agencies involved, it has led to a morass of needless paperwork, and there is a lot you can cut out . . . our findings on the process are that the process can be made to work efficiently.[363]

In its February 1977 report, *Environmental Impact Statements*,[364] the Commission made 14 recommendations on how to improve the process, including a recommendation that the President should require all federal agencies to develop consistent regulations and definitions and assure coordination among federal agencies in EIS preparation. The President's new Executive order, requiring agencies to conform with new CEQ regulations and stressing the CEQ coordinating responsibilities, is intended to accomplish this goal.

The Commission also emphasized that preparing impact statements represents only one aspect of environmental review and that agencies have the responsibility and opportunity for innovation to use NEPA for effective preservation and enhancement of the environment while simultaneously reducing paperwork. Other recommendations concerned the early conduct of environmental review and integration of EIS preparation with project planning; elimination of duplicative federal and state reviews; more frequent use of program impact statements, such as the areawide statement currently being prepared by HUD and the VA in Denver; preparation of an adequate EIS summary document; and development of better guidance and environmental inventories.

A General Accounting Office report examined NEPA's implementation by public works agencies and came to many of the same conclusions.[365] GAO found that proper administration of NEPA did not cause delays. The GAO report stressed, in particular, earlier preparation of impact statements in conjunction with agency planning. Many impact statements simply justify agency decisions rather than guiding decisions through independent analysis. The report recommended that statements be completed before an agency submits a project proposal to the Congress for approval. Statements would then be prepared before an agency commits itself to any alternative.

The President specifically directed CEQ in developing NEPA regulations to include procedures for referring important conflicts among agencies over matters of environmental substance to the Council. Several such conflicts have been referred to us in the past year under NEPA and Section 309 of the Clean Air Act.[366]

Another Presidential directive is to examine all federal environmental review requirements and to recommend specific measures, including legislation, to clarify and integrate them in a way compatible with the President's reorganization proposals.

EVENTS IN THE COURTS

The most significant court decisions on NEPA during the past year concerned comprehensive program impact statements. The Supreme Court's first extensive treatment of NEPA's program impact statement requirements was in *Kleppe* v. *Sierra Club*,[367] which concerned Interior Department actions to develop coal in the Northern Great Plains. The decision affirmed the NEPA requirement for comprehensive impact statements when cumulative impacts are involved, but it upheld Interior's decision not to prepare a regional EIS for the Northern Great Plains on the grounds that Interior was not proposing a regionwide action affecting the Northern Great Plains region as such and that its decision not to undertake a regionwide plan of development was not arbitrary.

A case that came up soon after *Kleppe* proved to be one of the most important program statement cases of the year. In *Swain* v. *Brinegar*, the U.S. Court of Appeals for the Seventh Circuit rejected the Federal Highway Administration's plan to prepare an EIS for one 15-mile segment of a 42-mile highway project in Illinois and reaffirmed the necessity to prepare a program impact statement if an individual action is an integral part of a larger federal program and completion of the individual action could foreclose later project alternatives.[368] The court cited the longstanding NEPA goal of eliminating potentially disastrous errors that may result when the cumulative impacts of individual parts of programs are ignored. This case served notice, immediately after the *Kleppe* decision, that the comprehensive program impact statement is still very much alive.

The Supreme Court had indicated in *Kleppe* that in certain circumstances when a particular action is substantially independent of other actions to be included in a comprehensive EIS, interim activity may begin on the single action if an adequate EIS is prepared for it and if its effects are analyzed cumulatively in the final comprehensive statement.[369] In the first major application of this rule on interim activity, the U.S. Second Circuit Court of Appeals recently denied a motion to rehear its earlier decision against interim licensing by the Nuclear Regulatory Commission of facilities to reprocess spent nuclear fuel.[370] In reaffirming its earlier decision, the Court emphasized the close tie between interim licensing for this purpose and proposed wide scale reprocessing. The Court suggested that interim licensing might prejudice the NRC's generic decision on wide scale reprocessing and effectively foreclose the development of environmental safeguards for this new technology. These two decisions affirm the principle that an action must be independent of related actions if it is to go forward in advance of a comprehensive impact statement. The U.S. Supreme Court has granted review in the NRC case.

Other lower court applications of the *Kleppe* rules are consistent with the general principles outlined above. In a case involving logging in the Superior National Forest, Minnesota, the U.S. Eighth Circuit Court of Appeals held that the Forest Service must update a comprehensive impact statement concerning its overall logging plans in the area before authorizing further activity.[371] Already authorized logging was allowed to continue, however, because it is adequately covered by an individual EIS and because it is not interdependent with future activity. The Supreme Court denied certiorari in the case. Two District Courts used the *Kleppe* case as grounds to hold that there was no current need for a comprehensive EIS for the Bureau of Reclamation's Oahe Diversion Unit of the Missouri River Basin Project in South Dakota[372] and that the General Services Administration could segment its EIS on the sale of some surplus land because the segmented section's historical and recreational value made it "environmentally independent."[373]

Both the comprehensiveness and scope of individual project EIS's received judicial attention in the past year. In the *Vermont Yankee* nuclear powerplant case,[374] the U.S. Circuit Court of Appeals for the District of Columbia held that the NRC must consider the environmental effects of reprocessing and disposing of radioactive wastes in an EIS *before* granting an operating license for a nuclear powerplant. Judge Bazelon said that the NRC plan to defer the crucial reprocessing and disposal questions until after construction was a classic example of the kind of incremental decisionmaking that NEPA was designed to remedy. He also pointed out (citing *Kleppe* as authority) that consideration of disposal and reprocessing issues must include the cumulative impacts of reactor licensing—not just the wastes from one reactor.[375] The Supreme Court has granted review of this case.

Also headed for the Supreme Court is a decision of the same Court of Appeals holding that the NRC was obliged to consider energy conservation as an alternative to nuclear power in its environmental impact statement on a Midland, Michigan, nuclear powerplant after intervenors had raised the issue of conservation in a comment on the EIS.[376] The court rejected a threshold test that the NRC had devised requiring commenters to specify the significance of an alternative before licensing boards were required to consider it. With this decision, the court reaffirmed the long-standing NEPA principle that it is the primary responsibility of the *agency* to take the initiative in raising environmental issues in the NEPA process[377] and that intervenor comments, such as those made here, should merely trigger the agency's own independent investigation of the issue raised.

Since NEPA's enactment, five Circuit Courts of Appeals have explicitly adopted the position that NEPA imposes substantive requirements on federal agencies. All five rejected the argument that the declaration of national environmental policy consists only of vague goals; rather, NEPA's Section 101 presents sufficiently definite standards to permit meaningful judicial review.[378]

Similarly, several state courts have ruled on this issue with regard to state environmental policy acts ("little NEPA's").[379] The leading case is still *Friends of Mammoth* v. *Mono County,* in which the California Supreme Court stated: "Obviously if the adverse consequences of the environment can be mitigated, or if feasible alternatives are available, the proposed activity, such as the issuance of a permit, should not be approved." [380]

The clearest holding on the subject of a substantive requirement is *Burger* v. *County of Mendocino.*[381] In that case, a developer applied for a permit to build a large motel in an environmentally fragile forest. Although an environmental impact statement concluded that of seven alternatives the applicant's was the worst environmentally, a local agency approved the application as submitted. The State Court of Appeals reversed the decision because the evidence did not support disregard of the impact statement and the agency had illegally approved the project.[382] This case involved review of a decision, not simply an EIS.

Amendments effective in January 1977 to the California Environmental Quality Act of 1970 codify a substantive requirement to protect the environment when it is feasible.[383] California was the second state to do so, New York having imposed an explicit substantive obligation in its Environmental Conservation Law.[384] The California statute codified case law which had in turn been based on the policy declarations of the statute.

In short, both federal and state courts have moved from insistence on adherence to NEPA's procedures (Section 102(2)) to implementation of NEPA's substance (Sections 101, 102(1)). The courts are emphasizing the need for better actions rather than simply requiring better environmental impact statements.

HUD BLOCK GRANTS AND NEPA

In May the Council transmitted to the Congress and to HUD its evaluation of the Community Development Block Grant Program and NEPA.[385] Under Section 104(h) of the Housing and Community Development Act of 1974, HUD was authorized to transfer its NEPA responsibilities for the Block Grant Program to the cities receiving the funds.

The block grant program is the first federal assistance program to give all decisionmaking authority to grantees. Because of this unique structure, CEQ and HUD supported the legislation to provide for delegation of NEPA responsibilities.

The report concluded that the statutory delegation was sound but that HUD regulations and assistance to the cities needed improvement. We recommended that HUD take a more active role in reviewing EIS's and in providing training and technical assistance to the cities. We also recommended detailed changes in the regulations to encourage cities to concentrate on significant environmental impacts of their community development programs.

HUD responded by accepting all the recommendations. Proposed revisions to the regulations were expected to be published in the *Federal Register* for public scrutiny in the fall.

NEPA LITIGATION

This year's survey of agency experience with NEPA litigation confirmed last year's finding that the NEPA cases ending in court are a small proportion of the many thousands of federal actions assessed for environmental impacts. As of June 30, 1976, 783 NEPA cases had been filed against the federal agencies surveyed. Since NEPA's enactment, a total of 7,334 EIS's have been filed, and tens of thousands of environmental assessments were made each year.

The number of NEPA cases filed rose steadily each year to a high of 182 in 1974 but dropped to 143 in 1975. The drop may not represent a trend; 89 were filed in the first half of 1976.

The agencies most affected by NEPA litigation remained much the same as in last year's survey, although the Department of the Interior has moved up on the list. Transportation had the most NEPA cases, 188 (24 percent of the total), followed by Interior with 139 cases (18 percent), the Department of Housing and Urban Development with 120 cases (15 percent), the Army Corps of Engineers with 93 cases (12 percent), and Agriculture with 77 cases (10 percent). The types of actions most affected reflect agency litigation experience. Actions most litigated were highway construction projects, with 142 cases (18 percent), urban renewal projects with 62 cases (8 percent), and dam construction projects with 41 cases (5 percent). Thirty cases (4 percent) challenged nuclear power projects.

Citizen and environmental groups were among the plaintiffs in 509 (65 percent) of the cases. Individuals appeared as plaintiffs in 385 cases (49 percent), business and industry in 111 cases (14 percent), local government in 89 cases (11 percent), state government in 52 cases (7 percent), unions in 16 cases (2 percent), and others in 24 cases (3 percent). Percentages total more than 100 because many cases include more than one kind of plaintiff. The number of allegations that agencies should have prepared an EIS but failed to do so has remained high—about 61 percent of the total cases, as shown in Tables 23 and 24.

Many agencies that prepare EIS's infrequently, such as the Civil Aeronautics Board, Consumer Product Safety Commission, Export-Import Bank, Federal Trade Commission, State Department, and Treasury Department, have found that most of their NEPA cases center on the question of whether an EIS must be prepared. The resolution of these cases, many of which are still pending in the courts, should help define the NEPA responsibilities of agencies whose actions do not have obvious effects on the environment. The question of whether an EIS is required also arises when an agency issues a negative declaration (that is, an explicit finding that no EIS is required). The circumstances calling for a full EIS and the appropriate content of negative declarations will be clarified in these cases. As the law develops and both agencies and potential plaintiffs learn how the courts are apt to interpret NEPA, the result is likely to be less litigation.

Of the 479 cases in which plaintiffs sought preparation of an EIS, so far 69 have been prepared as a result of the litigation. Agencies agreed to comply in 31 cases, which were then settled or dismissed; the courts ordered preparation of an EIS in 38. In 71 cases, an EIS was not required. The other cases are pending.

Of the 288 cases challenging the adequacy of an EIS, the courts found the EIS adequate in only 67 cases. In 12 cases, agencies either agreed to or were ordered to revise an EIS. Of the remaining cases, 59 were dismissed on procedural grounds and 18 were decided under other federal laws. In 11 cases the agency agreed to modify or stop a project, thus settling the case. Other cases were terminated in a variety of ways.

Of the NEPA cases completed, 210 were decided on the legal merits (not necessarily related to the project's merits); 55 were decided for the plaintiff and 155 for the agency. In addition, 155 cases were dismissed without trial, which in effect gave the decision to the agency.

Table 24 gives comparable figures for pending cases, many of which have not yet been heard by the trial court. Thirteen have been dismissed by the trial court, and 85 have been enjoined pending further action.

Actions delayed by injunctions granted under NEPA amount to only 177 cases in 6½ years, as Table 25 shows. This figure is less than 3 percent of the 7,334 actions for which impact statements were prepared and a much smaller proportion of the unknown—but very large—number of assessments made. In only 75 cases were projects delayed for more than 1 year. In 68 cases a NEPA-related injunction is presently in effect. In 547 of the cases reaching the courts, no injunctions were ordered. DOT had the most projects delayed because of NEPA, 47, and the most projects delayed for over 1 year, 25. The Corps of Engineers followed with 40 projects delayed, 15 for over 1 year; Agriculture had 24 projects delayed, 13 for more than 1 year. In no cases were actions stopped permanently solely because of a

Table 23

National Environmental Policy Act (NEPA)-Related Cases Completed

Agency	Cases	EIS's [1] alleged needed	Dismissed	Dismissed, no EIS	Dismissed, inadequate EIS	Injunction, no EIS	Injunction, inadequate EIS alleged	Permanent injunction [2]
USDA	43	34 (79)	15 (35)	12 (28)	3 (7)	8 (19)	3 (7)	0 (0)
USDA	4	4 (100)	2 (50)	2 (50)	0 (0)	1 (25)	0 (0)	0 (0)
APHI	1	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
FMHA	1	1 (100)	1 (100)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)
FS	31	24 (77)	11 (35)	9 (29)	2 (6)	5 (16)	1 (3)	0 (0)
REA	3	2 (67)	1 (33)	0 (0)	1 (33)	1 (33)	0 (0)	0 (0)
SCS	3	2 (67)	0 (0)	0 (0)	0 (0)	1 (33)	2 (67)	0 (0)
DOC	5	4 (80)	2 (40)	1 (20)	0 (0)	0 (0)	0 (0)	0 (0)
DOC	1	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
EDA	3	2 (67)	2 (67)	1 (33)	0 (0)	0 (0)	0 (0)	0 (0)
MA	1	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
CPSC	2	2 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
DOD	66	34 (52)	15 (23)	7 (11)	8 (12)	8 (12)	12 (18)	0 (0)
DOD	2	2 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
USAF	2	0 (0)	1 (50)	0 (0)	1 (50)	0 (0)	1 (50)	0 (0)
USA	3	1 (33)	1 (33)	0 (0)	1 (33)	0 (0)	0 (0)	0 (0)
COE	45	20 (44)	9 (20)	4 (9)	4 (9)	7 (16)	8 (18)	0 (0)
USN	14	11 (79)	4 (29)	3 (21)	2 (14)	1 (7)	3 (21)	0 (0)
DRBC	2	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
EPA	34	21 (60)	14 (40)	7 (20)	4 (11)	5 (14)	4 (11)	0 (0)
ERDA	3	3 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
FCC	3	1 (33)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
FEA	4	3 (75)	1 (25)	0 (0)	1 (25)	0 (0)	0 (0)	0 (0)
FPC	12	9 (75)	1 (8)	1 (8)	0 (0)	0 (0)	1 (8)	0 (0)

FTC	1	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
GSA	12	9 (75)	4 (33)	3 (25)	1 (8)	1 (8)	1 (8)	0 (0)
HEW	14	11 (79)	6 (43)	4 (29)	2 (14)	1 (7)	0 (0)	0 (0)
HEW	11	9 (82)	4 (36)	2 (18)	2 (18)	1 (9)	0 (0)	0 (0)
FDA	1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
IHS	1	1 (100)	1 (100)	1 (100)	0 (0)	0 (0)	0 0)	0 (0)
PHS	1	1 (100)	1 (100)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)
HUD	70	54 (75)	27 (38)	19 (26)	6 (8)	9 (13)	1 (1)	0 (0)
HUD	69	51 (74)	25 (36)	17 (25)	6 (9)	8 (12)	1 (1)	0 (0)
OILSR	1	1 (100)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)
DOI	55	33 (60)	8 (15)	7 (13)	6 (11)	6 (11)	4 (7)	0 (0)
DOI	19	12 (63)	4 (21)	3 (16)	2 (11)	3 (16)	2 (11)	0 (0)
BPA	1	0 (0)	1 (100)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)
BIA	2	1 (50)	1 (50)	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)
BLM	11	5 (45)	1 (9)	3 (27)	1 (9)	1 (9)	0 (0)	0 (0)
BOR	4	3 (75)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
BuRec	5	3 (60)	1 (20)	0 (0)	2 (40)	0 (0)	0 (0)	0 (0)
FWS	4	3 (75)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
USGS	1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
NPS	7	6 (85)	0 (0)	0 (0)	0 (0)	2 (49)	1 (14)	0 (0)
ICC	8	4 (50)	1 (13)	1 (13)	0 (0)	1 (13)	2 (25)	0 (0)
DJUS	16	12 (75)	5 (31)	5 (31)	1 (6)	2 (13)	2 (13)	0 (0)
DJUS	8	4 (50)	1 (13)	1 (13)	0 (0)	0 (0)	1 (13)	0 (0)
BP	2	2 (100)	0 (0)	0 (0)	0 (0)	1 (50)	1 (50)	0 (0)
INS	1	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
LEAA	5	5 (100)	4 (80)	4 (80)	1 (20)	1 (20)	0 (0)	0 (0)
NASA	3	1 (33)	0 (0)	0 (0)	0 (0)	0 (0)	2 (67)	0 (0)
NCPC	9	7 (78)	2 (22)	1 (11)	1 (11)	1 (11)	1 (11)	0 (0)
NRC	22	6 (27)	5 (23)	0 (0)	3 (14)	1 (5)	1 (5)	0 (0)
USPS	3	2 (67)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
SEC	4	0 (0)	2 (50)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
STATE	2	2 (100)	1 (50)	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)
TVA	13	12 (92)	2 (15)	2 (15)	1 (8)	1 (8)	1 (8)	0 (0)

See footnotes at end of table.

Table 23—Continued

National Environmental Policy Act (NEPA)-Related Cases Completed—Continued

Agency	Cases	EIS's[1] alleged needed	Dismissed	Dismissed, no EIS	Dismissed, inadequate EIS	Injunction, no EIS	Injunction, inadequate EIS alleged	Permanent injunction[2]
DOT	117	74 (62)	42 (35)	24 (20)	17 (15)	14 (12)	9 (8)	0 (0)
DOT	15	9 (60)	5 (33)	2 (13)	3 (20)	2 (13)	3 (20)	0 (0)
USCG	2	2 (100)	2 (100)	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)
FAA	10	8 (80)	2 (20)	2 (20)	0 (0)	0 (0)	0 (0)	0 (0)
FHWA	89	55 (61)	33 (37)	19 (21)	14 (16)	12 (13)	6 (7)	0 (0)
UMTA	1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
TREAS	12	11 (92)	2 (17)	2 (17)	0 (0)	2 (17)	0 (0)	0 (0)
TREAS	9	8 (89)	1 (11)	1 (11)	0 (0)	2 (22)	0 (0)	0 (0)
CS	1	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
ORS	2	2 (100)	1 (50)	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)
WRC	2	1 (50)	2 (100)	1 (50)	1 (50)	0 (0)	1 (50)	0 (0)
Total	[3]527	350 (66)	155 (29)	96 (18)	55 (10)	60 (11)	45 (9)	0 (0)

[1] Environmental impact statements.

[2] Injunctions which permanently halted the project.

[3] Represents 444 actual cases. The difference of 83 represents cases brought against more than one agency.

Table 24

National Environmental Policy Act (NEPA)-Related Cases Pending

Agency	Cases	EIS's[1] alleged needed	Dismissed	Dismissed, no EIS	Dismissed, inadequate EIS	Injunction, no EIS	Injunction, inadequate EIS alleged	Permanent injunction[2]
USDA	34	21 (62)	0 (0)	0 (0)	0 (0)	6 (18)	4 (12)	0 (0)
APHI	1	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
FMHA	1	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
FS	23	13 (57)	0 (0)	0 (0)	0 (0)	3 (13)	3 (13)	0 (0)
REA	1	1 (100)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)
SCS	8	5 (63)	0 (0)	0 (0)	0 (0)	2 (25)	1 (13)	0 (0)
CAB	4	4 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
DOC	2	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
CPSC	1	1 (100)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)
DOD	67	34 (52)	4 (6)	3 (5)	1 (2)	10 (15)	13 (20)	0 (0)
DOD	3	2 (67)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
USAF	4	3 (75)	0 (0)	0 (0)	0 (0)	1 (25)	0 (0)	0 (0)
USA	8	7 (88)	1 (13)	1 (13)	0 (0)	1 (13)	0 (0)	0 (0)
COE	48	20 (43)	3 (6)	2 (4)	1 (2)	7 (15)	13 (28)	0 (0)
USN	4	2 (50)	0 (0)	0 (0)	0 (0)	1 (25)	0 (0)	0 (0)
EPA	17	11 (65)	0 (0)	0 (0)	0 (0)	1 (6)	0 (0)	0 (0)
ERDA	6	6 (100)	1 (17)	1 (17)	0 (0)	0 (0)	0 (0)	0 (0)
EXIM	1	1 (100)	1 (100)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)
FCC	2	2 (100)	1 (50)	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)
FEA	4	4 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
FPC	4	2 (50)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
FTC	2	2 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
GSA	6	3 (50)	0 (0)	0 (0)	0 (0)	1 (17)	2 (33)	0 (0)
HEW	5	4 (80)	1 (20)	1 (20)	0 (0)	1 (20)	0 (0)	0 (0)
HEW	4	3 (75)	0 (0)	0 (0)	0 (0)	1 (25)	0 (0)	0 (0)
FDA	1	1 (100)	1 (100)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)
HUD	48	34 (71)	3 (6)	2 (4)	0 (0)	8 (17)	0 (0)	0 (0)
HUD	46	32 (70)	3 (7)	2 (4)	0 (0)	7 (15)	0 (0)	0 (0)
FDAA	1	1 (100)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)
OILSR	1	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

See footnotes at end of table.

Table 24—Continued

National Environmental Policy Act (NEPA)-Related Cases Pending—Continued

Agency	Cases	EIS's[1] alleged needed	Dismissed	Dismissed, no EIS	Dismissed, inadequate EIS	Injunction, no EIS	Injunction, inadequate EIS alleged	Permanent injunction[2]
DOI	85	45 (54)	0 (0)	4 (5)	1 (1)	4 (5)	6 (7)	0 (0)
DOI	22	13 (60)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
BIA	6	4 (67)	0 (0)	0 (0)	0 (0)	1 (17)	1 (17)	0 (0)
BLM	19	13 (67)	0 (0)	4 (21)	0 (0)	0 (0)	2 (11)	0 (0)
BPA	5	3 (60)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
BR	22	4 (18)	0 (0)	0 (0)	1 (4)	1 (4)	3 (14)	0 (0)
FWS	2	2 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
USGS	1	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
NPS	8	5 (63)	0 (0)	0 (0)	0 (0)	2 (25)	0 (0)	0 (0)
ICC	5	5 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
NCPC	1	1 (100)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)
NRC	14	2 (14)	0 (0)	0 (0)	0 (0)	0 (0)	3 (21)	0 (0)
OMB	1	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
USPS	11	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (9)	0 (0)
SEC	1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
STATE	2	2 (100)	1 (50)	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)
TVA	2	2 (100)	0 (0)	0 (0)	0 (0)	1 (50)	0 (0)	0 (0)
DOT	71	38 (53)	1 (1)	0 (0)	1 (1)	10 (14)	11 (16)	0 (0)
DOT	12	7 (58)	0 (0)	0 (0)	0 (0)	1 (8)	2 (17)	0 (0)
USCG	7	5 (71)	0 (0)	0 (0)	0 (0)	2 (29)	0 (0)	0 (0)
FAA	17	10 (59)	0 (0)	0 (0)	0 (0)	1 (6)	1 (6)	0 (0)
FHWA	35	16 (44)	1 (3)	0 (0)	1 (3)	7 (18)	8 (24)	0 (0)
TREAS	3	3 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
TREAS	1	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
CS	1	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
ORS	1	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Total	[3] 339	229 (57)	13 (3)	14 (4)	3 (1)	45 (11)	40 (10)	0 (0)

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[1] Environmental impact statements.

[2] Injunctions which permanently halted the project.

[3] This figure represents 339 actual cases. The difference of 60 represents cases brought against more than one agency.

Table 25

Injunctive Delay of Federal Actions under the National Environmental Policy Act (NEPA)

Injunctive action	Projects involved
Delayed by NEPA-related injunctions	
Up to 3 months	32
3 to 6 months	18
6 to 12 months	22
Over 12 months	75
Length of delay not indicated	30
Total	177
Permanently halted by NEPA-related injunctions	0
Delayed by non-NEPA-related injunctions	20
No injunctions	547
Injunction status not indicated	39
Total	783

NEPA injunction. Although in a particular case, an injunction might cause considerable delay, the delays caused by NEPA injunctions are small when viewed against the whole spectrum of federal activity.

Although no projects were stopped because of a NEPA injunction, several were stopped by decisions made after an injunction was issued. Table 26 examines the cases in which a project was cancelled after litigation began. Of 42 such projects, 14 were stopped after a NEPA injunction was issued in the last court; 28 were stopped with no injunction.

Table 26

Projects Cancelled as a Result of National Environmental Policy Act (NEPA) Injunctions

Projects cancelled	Reason
12	Local/state decision to halt a project involving federal funds
9	Federal decision to halt a project
6	Part of a settlement agreement
4	Applicant withdrew
2	Injunction granted under another law
2	Congressional action
[1] 2	Local/state decision to proceed without federal funds
1	Judicial interpretation of another law
1	Deferrence to congressional desires
1	Presidential decision to halt a project
1	Local land use conficts
1	Not indicated
42	

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[1] These two projects were continued on the local or state level; only the federal funding was cancelled.

STATE ENVIRONMENTAL IMPACT STATEMENT REQUIREMENTS, MAY 1, 1977

States with Comprehensive Statutory Requirements

CALIFORNIA

Source: California Environmental Quality Act of 1970, Cal. Pub. Res. Code, Section 21000–21176 (Supp. 1972), *as amended* by: Ch. 1154, Statutes of 1972, December 5, 1972; Ch. 895, Statutes of 1973, September 28, 1973; Ch. 56, Statutes of 1974, March 4, 1974; Ch. 276, Statutes of 1974, May 21, 1974; Ch. 1187, Statutes of 1975, September 30, 1975; Ch. 593, Statutes of 1976, August 27, 1976; Ch. 753, Statutes of 1976, September 7, 1976; Ch. 1312, Statutes of 1976, September 29, 1976.

Guidelines: California Administrative Code, Title 14, Division 6, Ch. 3 (Sections 15000 through 15192) and appendices adopted February 3, 1973, *as amended* December 14, 1973, January 18, 1974, March 26, 1974, December 30, 1974, January 30, 1975, February 18, 1975, January 6, 1976, October 8, 1976, December 8, 1976, December 23, 1976. Guidelines are prepared by the Resources Agency of California.

State Contact: Norman E. Hill, Assistant to the Secretary for Resources, The Resources Agency, 1414 Ninth Street, Sacramento, California 95815 (Phone: 916–445–9134).

CONNECTICUT

Source: Connecticut Environmental Policy Act of 1973, Pub. Act 73–562 (approved June 22, 1973), Conn. Gen. Stat. Ann. Ch. 439, Section 22a–1 *et seq.* (Cum. Supp. 1974–1975), effective February 1, 1975.

Guidelines: None.

State Contact: Gregory Sharp, Director, Information and Education, Department of Environmental Protection, State Office Building, Room 114, Hartford, Connecticut 06115 (Phone: 203–566–3489).

HAWAII

Source: Governor's Executive Order of August 21, 1974, as supplemented by Act 246, Sess. Laws of Hawaii (approved June 4, 1974), Hawaii Rev. Stat. Ch. 343 (1974).

Guidelines: "Rules and Regulations Pertaining to Chapter 343," promulgated in September 1975 by the Hawaii Environmental Quality Commission.

State Contact: Richard E. Marland, Director, Office of Environmental Quality Control, Office of the Governor, 550 Halekauwila Street, Room 301, Honolulu, Hawaii 96813 (Phone: 808–548–6915).

INDIANA

Source: IC 1971, 13–1–10–3, *added by* Pub. L. 98, 1972, Ind. Stat. Ann. Section 1–301(c) (effective July 1, 1975).

Guidelines: EMB–2; "The Definition of Actions of State Agencies Which Have a Significant Environmental Impact," effective August 7, 1975.

State Contact: Ralph Pickard, Technical Secretary, Environmental Management Board, 1330 W. Michigan Street, Indianapolis, Indiana 46206 (Phone: 317–633–4420).

MARYLAND

Source: Maryland Environmental Policy Act of 1973, Ch. 702, Md. Acts of 1973, 41 Ann. Code of Md., Section 447–451 (Cum. Supp. 1973), and Ch. 703, Md. Acts of 1973 Natural Res. Art., Ann. Code of Md., Section 1–301 *et seq.* (1974 Volume) *as amended* by Ch. 129 of the Md. Acts of 1975.

Guidelines: "Revised Guidelines for Implementation of the Maryland Environmental Policy Act," issued by the Secretary of the Department of Natural Resources, June 15, 1974.

State Contact: Joseph Knapp, Administrator, Clearing House Review, Department of Natural Resources, Tawes State Office Building, Annapolis, Maryland 21401 (Phone: 301–269–3548).

MASSACHUSETTS

Source: Ch. 781, Acts of 1972, Ann. Laws Mass. Ch. 30, Section 61–62 (Cum. Supp. 1973), *as amended* by Ch. 257 of the Acts of 1974.

Guidelines: "Regulations to Create a Uniform System for the Preparation of Environmental Impact Reports," July 6, 1973, *as amended* October 15, 1973, January 8, 1975. Guidelines are prepared by the Executive Office of Environmental Affairs.

State Contact: William Hicks, Director, MEPA Programs, Executive Office of Environmental Affairs, 100 Cambridge Street, Room 2000, Boston, Massachusetts 02202 (Phone: 617–727–7700).

MINNESOTA

Source: Minnesota Environmental Policy Act of 1973, Ch. 412, Laws of 1973, Minn. Stat. Ann. Ch. 116D (Cum. Supp. 1974).

Guidelines: "Rules and Regulations for Environmental Impact Statements," issued by the Minnesota Environmental Quality Council on April 4, 1974, *as amended* February 13, 1977.

State Contact: Joe Sizer, Director, Environmental Planning, Environmental Quality Council, Capital Square Building, 550 Cedar Street, St. Paul, Minnesota 55101 (Phone: 612–296–2712).

MONTANA

Source: Montana Environmental Policy Act of 1971, Ch. 238, L. 1971, Rev. Code Mont., Section 69–6501 *et seq.* (Cum. Supp. 1973), *as amended* April 21, 1975 (Ch. 65, Section 69–6508 and Section 69–6509).

Guidelines: Montana Environmental Quality Council, "Revised Guidelines for Environmental Impact Statements Required by the Montana Environmental Policy Act of 1971," issued September 19, 1975.

State Contact: Steven Perlmutter, Staff Attorney, Montana Environmental Quality Council, Capitol Station, Helena, Montana 59601 (Phone: 406–449–3742).

NEW YORK

Source: New York State Environmental Quality Review Act, Art. 8, New York State Environmental Conservation Law, effective June 1, 1976, *as amended and added* by Section 8–0117 (May 28, 1976).

Guidelines: 6 N.Y.C.R.R., Part 617, effective September 1, 1976.

State Contact: Jane Magee, CEQRA Coordinator, New York State Department of Environmental Conservation, 50 Wolf Road, Albany, New York 12233 (Phone: 518–457–6557).

NORTH CAROLINA

Source: North Carolina Environmental Policy Act of 1971 (1971, c. 1203, s.1), N.C. Gen. Stat. Ch. 113A (Cum. Supp. 1973).

Guidelines: North Carolina Department of Administration, "Guidelines for the Implementation of the Environmental Policy Act of 1971," issued February 18, 1972, updated March 1, 1975.

State Contact: Robert Thayer Broili, Environmental Planning Consultant, Department of Natural and Economic Resources, P.O. Box 27687, Raleigh, North Carolina 27611 (Phone: 919-733-2955).

SOUTH DAKOTA

Source: South Dakota Environmental Policy Act, SL 1974, Ch. 245 (approved March 2, 1974), S.D. Comp. Laws 1967, Ch. 11-1A (Supp. 1974).

Guidelines: Department of Environmental Protection, 1974 Informal Guidelines.

State Contact: Harold Lenhart, South Dakota Department of Environmental Protection, Foss Building, Pierre, South Dakota 57501 (Phone: 605-224-3351).

VIRGINIA

Source: Virginia Environmental Quality Act of 1973, Ch. 384, Laws of 1973 (approved March 15, 1973) and Ch. 774, Laws of 1972, Va. Code Ann. Sections 10-17.107 through 10-17.112 and 10-177 through 10-186 (Supp. 1973), *as amended* by Ch. 354, Laws of 1974 (approved April 4, 1974), Va. Code Ann. Section 2.1-51.9, Section 10.181, Section 10.183, and Section 10.185, *as amended* by Ch. 404, Acts of Assembly, 1977.

Guidelines: Procedures Manual for Environmental Impact Statements in the Commonwealth of Virginia, issued by the Governor's Council on the Environment (December 1973; revised January 1975).

State Contact: Reginald Wallace, Environmental Impact Statement Coordinator, Governor's Office, Council on the Environment, Eighth Street Office Building, Richmond, Virginia 23219 (Phone: 804-786-4500).

WASHINGTON

Source: State Environmental Policy Act of 1971, Rev. Code Wash. Ch. 43.21C (Supp. 1973), *as amended* by Sub. Senate Bill 3277, Ch. 179, Laws of 1974 (May 5, 1974).

NOTE: For State Highway Project Environmental Impact Report Requirements, see Rev. Code Wash. Ch. 47.04 (Supp. 1973).

Guidelines: "Guidelines for Implementation of the State Environmental Policy Act of 1971," prepared by the Department of Ecology, as revised by "State Environmental Policy Act Guidelines" (WAC 197-10), issued by the Council on Environmental Policy, January 16, 1976.

State Contact: Peter R. Haskin, Environmental Review Section, Office of Comprehensive Programs, State of Washington Department of Ecology, Olympia, Washington 98504 (Phone: 206-753-6890).

WISCONSIN

Source: Wisconsin Environmental Policy Act of 1971, Ch. 274, Laws of 1971, adding Wisc. Stat. Ann. Ch. 1, Section 1.11, *et seq.* (Cum. Supp. 1974-1975).

Guidelines: "Guidelines for the Implementation of the Wisconsin Environmental Policy Act," issued by Governor's Executive Order No. 69 (December 1973).

State Contact: Caryl Terrell, State WEPA Coordinator, Office of State Planning and Energy, State Capital, Madison, Wisconsin 53702 (Phone: 608-266-1718).

PUERTO RICO

Source: Puerto Rico Environmental Policy Act, 12 Laws P.R. Ann. Section 1121, *et seq.* (1970).

Guidelines: "Guidelines for the Preparation, Evaluation, and Use of Environmental Impact Statements," issued by the Environmental Quality Board on December 19, 1972.

Contact: Roberto Rexach, Executive Director, Environmental Quality Board, 1550 Ponce de Leon Avenue, 4th Floor, Santurce, Puerto Rico 19910 (Phone: 809–725–5140).

States with
Comprehensive Executive or Administrative Orders

MICHIGAN

Source: Michigan Executive Directive 1971–10, as superceded by Michigan Executive Order 1973–9, as superceded by Michigan Executive Order 1974–4 (May 1974).

Guidelines: Interim Guidelines, prepared by the Environmental Review Board and issued June 24, 1974. Revised guidelines were adopted in November 1975.

State Contact: Terry L. Yonker, Executive Secretary, Environmental Review Board, Department of Management and Budget, Lansing, Michigan 48913 (Phone: 517–373–0933).

NEW JERSEY

Source: New Jersey Executive Order No. 53 (October 15, 1973).

Guidelines: "Guidelines for the Preparation of an Environmental Impact Statement," issued by the Office of the Commissioner, Department of Environmental Protection, in 1973 and updated in February 1974.

State Contact: Lawrence Schmidt, Chief, Office of Environmental Review, Department of Environmental Protection, P.O. Box 1390, Trenton, New Jersey 08625 (Phone: 609–292–2662).

TEXAS

Source and Guidelines: Policy for the Environment, adopted by the Interagency Council on Natural Resources and the Environment on March 7, 1972, and published in "Environment for Tomorrow: The Texas Response," subsequently updated by "The Environment Policy—Guidelines and Procedures for Processing EISs," developed and adopted by the Interagency Council on Natural Resources and the Environment, published November 1975.

State Contact: Charles D. Travis, Director, Governor's Budget and Planning Office, Executive Office Building, 411 W. 13th Street, Austin, Texas 78701 (Phone: 512–475–6156).

UTAH

Source: State of Utah Executive Order, August 27, 1974.

Guidelines: As above.

State Contact: William C. Quigley, Assistant Attorney General, State Capitol Building, Office of the Attorney General, Salt Lake City, Utah 84114 (Phone: 801–533–7643).

States with Special or Limited EIS Requirements

ARIZONA

Source: Game and Fish Commission Policy of July 2, 1971.

Guidelines: Memorandum by the Arizona Game and Fish Commission, "Requirements for Environmental Impact Statements," issued June 9, 1971.

State Contact: Robert D. Curtis, Chief, Wildlife Planning and Development Division, Arizona Game and Fish Commission, 2222 W. Greenway Rd., Phoenix, Arizona 85023 (Phone: 602-942-3000).

DELAWARE

Source: a) Delaware Coastal Zone Act, Ch. 175, Vol. 58, Laws of Del. (June 28, 1971), *adding* Del. Code Ann. Section 7001 *et seq.* (Supp. 1973), and b) Delaware Wetlands Law of 1973, adding 7 Del. Code Ann. Ch. 66 (Supp. 1973).

Guidelines: a) 7 Del. Code Ann. Ch. 66, Section 6604 (Supp. 1973), and "Permit Application Instructions and Forms and Information Material on Required Procedures for the Coastal Zone Act," prepared and published by the Delaware State Planning Office (effective July 1, 1977); this office will be known as the Delaware Office of Management, Budget, and Planning), and b) "Department of Natural Resources and Environmental Control, Wetlands Regulations," adopted pursuant to Section 6607 of the Wetlands Act, effective December 23, 1976.

State Contact: a) For the Coastal Zone Act—David Hugg, Manager, Coastal Zone Program, Delaware Office of Management, Budget, and Planning, Dover, Delaware 19901 (Phone: 302-678-4271).

b) For the Wetlands Act—William Moyer, Wetlands Manager, Department of Natural Resources and Environmental Control, Division of Environmental Control, Dover, Delaware 19901 (Phone: 302-678-4761).

GEORGIA

Source: Ga. L. 1972-179 (March 10, 1972), Ga. Code Ann. Ch. 95A-1, Section 241(e)(1)(1973).

Guidelines: Policy and Procedures Manual: State Tollway Authority, prepared by Georgia's Tollway Administrator's Office in May, 1972 and revised in February, 1973.

State Contact: Robert L. Austin, State Location Engineer, Division of Preconstruction, Department of Transportation, 2 Capitol Square, Atlanta, Georgia 30334 (Phone: 404-656-5312).

MISSISSIPPI

Source: Title 49, Chapter 27, Mississippi Code of 1972, Section 49-27:1—49-27:69, amended in 1974 to include 49-27-7(s), relating to Wetlands.

Guidelines: Rules and Regulations written by the Mississippi Marine Resources Council, July 10, 1973, revised April 15, 1975.

State Contact: Joe Gill, Jr., Marine Projects Manager, Mississippi Marine Resources Council, P.O. Drawer 959, Long Beach, Mississippi 39560 (Phone: 601-864-4602).

NEBRASKA

Source and Guidelines: Nebraska Department of Roads, *Department of Roads Action Plan* (1973), as revised by the *State of Nebraska Environmental Action Plan,* prepared by the Nebraska Department of Roads and approved by the Federal Highway Administration, June 24, 1975.

State Contact: Robert O. Kuzelka, Comprehensive Planning Coordinator, Office of Planning and Programming, Box 94601, State Capital, Lincoln, Nebraska 68509 (Phone: 402-471-2414).

NEVADA

Source: Ch. 311, Laws of 1971, 58 N.R.S. Ch. 704 (1971).

Guidelines: No guidelines have been issued.

State Contact: Ernest Gregory, Administrator, Environmental Protection Services, Department of Human Resources, 505 E. King Street, Room 600, Carson City, Nevada 89710 (Phone: 702-885-4730).

NEW JERSEY

Source: a) Coastal Area Facility Review Act, P.L. 1973, Ch. 185 (approved June 20, 1973), N.J.S.A. 13:19-1 *et seq.* (Cum. Supp. 1974-1975), and b) The New Jersey Wetlands Act of 1970, Ch. 272, Laws of 1970, N.J.S.A. 13:9A-1 *et seq.* (Cum. Supp. 1974-1975).

Guidelines: a) "Procedural Rules for the Administration of the Coastal Area Facility Review Act," prepared by the Department of Environmental Protection in 1974 and adopted April 1, 1977 and b) "New Jersey Wetlands Order: Basis and Background," issued by the New Jersey Department of Environmental Protection, April 1972, "Procedural Rules and Regulations to Implement the Wetlands Order," N.J.A.C. 7:7A-1 *et seq.*, adopted September 2, 1976.

State Contact: a) David N. Kinsey, Chief, Office of Coastal Zone Management, New Jersey Department of Environmental Protection, P.O. Box 1889, Trenton, N.J. 08625 (Phone: 609-292-8262), and b) Thomas F. Hampton, Supervisor, Office of Wetlands Management, Division of Marine Services, Department of Environmental Protection, P.O. Box 1889, Trenton, N.J. 08625 (Phone: 609-292-8202).

City NEPA's

BOWIE, MARYLAND

Source and Guidelines: The Bowie, Maryland Environmental Policy and Impact Statement Ordinance, passed by the City Council of Bowie, Maryland on May 3, 1971, and Ordinance 0-2-73 of the City Council of Bowie, Maryland, Declaring an Environmental Policy and Providing for Environmental Impact Statements, passed July 16, 1973, and Ordinance 0-14-76, Changing Notification and Referral Requirements under the Ordinance, passed September 8, 1976.

Contact: Bradford Pryce, Planning Director, Office of Planning and Community Development, City Hall, Bowie, Maryland 20715 (Phone: 301-262-6200).

NEW YORK CITY

Source: Executive Order No. 91, June 1, 1977. New York City is currently working on a replacement policy which will incorporate the Executive Order and the requirements of the New York State Law.

Guidelines: A "City Environmental Policy Executive Order Environmental Information Form" is utilized for environmental analysis. The Information Form was prepared by the City of New York Environmental Protection Administration in 1973.

Contact: Dorothy Green, Director, Office of Environmental Impact, New York City Department of Environmental Protection, Room 2344, Municipal Building, New York, New York 10007 (Phone: 212-566-4107).

CHAPTER REFERENCES

TOXIC SUBSTANCES

1. Pub. L. 94–469, 90 Stat. 2003, 15 U.S.C. § 2601 (1976).
2. *Marshall v. Velsicol Chemical Corp.*, OSHRC Docket No. 77–370.
3. Statement by H. A. Anderson, Hearings on Toxic Substances Before the Subcommittee on Science, Technology, and Space of the Senate Committee on Commerce, Science and Transportation, 95th Cong., 1st Sess. (1977).
4. Michigan Department of Agriculture, Bureau of Consumer Protection, news releases, March 11, 14, 18, 22, 23, April 19, 1977.
5. U.S. Environmental Protection Agency, Office of Water Supply and Office of Solid Waste Management Programs, *The Report to Congress: Waste Disposal Practices and Their Effects on Ground Water* (Washington, D.C., 1976).
6. U. Saffiotti, "Carcinogenesis, 1957–77: Notes for a Historical Review," *J. Nat'l Cancer Inst.* 53:1395 (1977).
7. Pub. L. 94–469, 90 Stat. 2003, 15 U.S.C. § 2601 (1976).
8. *Id.* § 5.
9. *Id.* § 4.
10. *Ibid.*
11. *Id.* § 6.
12. *Id.* § 8.
13. 41 Fed. Reg. 51206 (1976).
14. Pub. L. 75–717, 52 Stat. 1040, 21 U.S.C. §§ 301–372 (1938).
15. Pub. L. 90–602, 82 Stat. 1173–1186, 42 U.S.C. §§263b–263n (1968).
16. 41 Fed. Reg. 51207 (1976).
17. 41 Fed. Reg. 51208 (1976).
18. 41 Fed. Reg. 43920 (1976).
19. 42 Fed. Reg. 13130 (1977).
20. 42 Fed. Reg. 39481 (1977).
21. 42 Fed. Reg. 21639 (1977).
22. 42 Fed. Reg. 13581 (1977).
23. Federal Environmental Pesticide Control Act Amendments of 1975, Pub. L. 94–140, § 1, 89 Stat. 751 (amending 7 U.S.C. § 135 *et seq.* (1972)).
24. Federal Insecticide, Fungicide, and Rodenticide Act of 1947, § 6(b), Pub. L. 80–104, 61 Stat. 163, 7 U.S.C. § 135 (1947) (as amended).
25. Interview with Jesse Mays, Office of Pesticide Programs, Environmental Protection Agency, October 3, 1977.
26. 41 Fed. Reg. 21402 (1976).
27. National Cancer Advisory Board, Subcommittee on Environmental Carcinogenesis, "General Criteria for Assessing the Evidence for Carcinogenicity of Chemical Substances: Report of the Subcommittee on Environmental Carcinogenesis, National Cancer Advisory Board," *J. Nat'l. Cancer Institute* 58:461 (1977).
28. 42 Fed. Reg. 54148 (1977).
29. U.S. Department of Labor, Occupational Safety and Health Administration, "New 'Common Sense' Priorities Set for Job Safety and Health Agency," news release, May 19, 1977.
30. 42 Fed Reg. 5372 (1977).
31. *Independent Cosmetic Manufacturers and Distributors, Inc.* v. *Department of Health, Education, and Welfare*, No. 75–1845 (D.C. Cir., January 27, 1977); *Independent Cosmetic Manufacturers and Distributors, Inc.* v. *Mathews*, No. 76–1007 (D.C. Cir., January 27, 1977).
32. Federal Food, Drug, and Cosmetic Act of 1938, Pub. L. 75–717, 52 Stat. 1040, 21 U.S.C. §§ 301–392 (1938) (as amended).

33. Fair Packaging and Labeling Act of 1966, Pub. L. 89–755, 80 Stat. 1296, 15 U.S.C. §§ 1451–61 (1966) (as amended).
34. 42 Fed. Reg. 15554–676 (1977).
35. 42 Fed. Reg. 24536 (1977) (FDA); 42 Fed. Reg. 24542 (1977) (EPA); 42 Fed. Reg. 24550 (1977) (CPSC).
36. 42 Fed. Reg. 9205 (1977); 42 Fed. Reg. 22018–22034 (1977).
37. 42 Fed. Reg. 21807–09 (1977).
38. 42 Fed. Reg. 9205 (1977).
39. Council on Atmospheric Sciences, press release, April 29, 1977.
40. *Environmental Defense Fund* v. *Train*, No. 76–2045 (D.C. Cir., filed November 19, 1976), dismissed after settlement, June 24, 1977.
41. 42 Fed. Reg. 28154 (1977).
42. Clean Air Act Amendments of 1970, § 112, Pub. L. 91–604, 84 Stat. 1676 (amending 42 U.S.C. §§ 1857–1857(l) (1965).
43. 42 Fed. Reg. 46560 (1977).
44. 42 Fed. Reg. 12122 (1977).
45. 40 CFR 61.22(d).
46. 42 Fed. Reg. 29332 (1977).
47. Federal Water Pollution Control Act Amendments of 1972, Pub. L. 92–500, § 307(a), 86 Stat. 816 (amending Act of July 17, 1952, ch. 927, 66 Stat. 755, 33 U.S.C. § 1317.
48. 42 Fed. Reg. 2588 (1977); 42 Fed. Reg. 2617 (1977).
49. 42 Fed. Reg. 6532 (1977).
50. *Natural Resources Defense Council* v. *Train*, Civ. No. 75–172, 8 ERC 2120 (D.D.C. June 9, 1976).
51. Safe Drinking Water Act of 1974, Pub. L. No. 93–523, 88 Stat. 1660, 42 U.S.C. § 300f (1974).
52. 40 Fed. Reg. 59566–88 (1975).
53. 41 Fed. Reg. 28401–28409 (1976).
54. *Environmental Defense Fund* v. *Train*, No. 75–2224 (D.C. Cir., filed December 17, 1975).
55. Brief for Petitioner, *Environmental Defense Fund* v. *Train*, No. 75–2224 (D.D.C., filed December 17, 1975).
56. 41 Fed. Reg. 28991 (1976).
57. 42 Fed. Reg. 35764 (1977).
58. Pub. L. 93–523, 88 Stat. 1660, 42 U.S.C. § 300f (1974).
59. 42 Fed. Reg. 17143-47 (1977).
60. 41 Fed. Reg. 36726 (1976).
61. 41 Fed. Reg. 56694 (1976).
62. *Environmental Defense Fund, Inc.* v. *EPA*, 548 F.2d 998 (D.C. Cir., 1976).
63. 41 Fed. Reg. 21859 (1976).
64. 41 Fed. Reg. 26607 (1976).
65. 42 Fed. Reg. 11039 (1977); 42 Fed. Reg. 16844 (1977); 42 Fed. Reg. 29951 (1977).
66. 42 Fed. Reg. 19209 (1977).
67. Interview with David Nematti, Office of Pesticide Programs, Environmental Protection Agency, October 3, 1977.
68. *United States* v. *Life Sciences Products Co., et al.*, No. 76–0130 (E.D. Va. June 25, 1976).
69. D. Hansen *et al.* "Kepone: Hazard to Aquatic Organisms," *Science* 193:528 (1976).
70. C.J. Cueto, N.P. Page, and U. Saffiotti, "Report on Carcinogenesis Bioassay of Technical Grade Chlordecone (Kepone)," *Clinical Toxicology* 9:603 (1976) (also available from National Technical Information Service, ISS PB–264 041).

71. "High Kepone Levels Found in Chesapeake Fish," *New York Times*, August 18, 1976, p. 47.
72. U.S. Department of Health, Education, and Welfare, Food and Drug Administration, "FDA Talk Paper: Kepone and Mirex Survey," February 10, 1977.
73. U.S. Department of Health, Education, and Welfare, Food and Drug Administration, "FDA Talk Paper: Kepone Action Level," March 18, 1977.
74. "Kepone Incinerator Likely," *New York Times*, March 5, 1977, p. 3.
75. *United States* v. *Allied Chemical Corp.*, No. 76-0129-R (E.D. Va. October 5, 1976).
76. *United States* v. *Allied Chemical Corp.*, No. 76–0129–R (E.D. Va. February 1, 1977).
77. *United States* v. *Life Science Products Co., et al.*, No. 76–0130–R (E.D. Va. June 25, 1976); *United States* v. *Life Science Products, et al.*, No. 76-0187-R (E.D. October 5, 1975).
78. *Earl John Harvey, et al.* v. *Allied Chemical Corp.* (E.D. Va., filed August 19, 1977).
79. 42 Fed. Reg. 22516 (1977).
80. Occupational Safety and Health Act, Pub. L. 91–596, 84 Stat. 1593, 29 U.S.C. § 655(c)(3).
81. 42 Fed. Reg. 29332 (1977).
82. Toxic Substances Control Act of 1976, Pub. L. 94–469, 90 Stat. 2003, 15 U.S.C. § 2601 (1976).
83. Clean Air Act of 1963, 42 U.S.C. § 1857 *et seq.* (1963).
84. 42 Fed. Reg. 18850 (1977).
85. Arlene Blum and Bruce N. Ames, "Flame Retardant Additives as Possible Cancer Hazards," *Science* 195:17–23 (1977).
86. *Id.* p. 17.
87. 42 Fed. Reg. 18850 (1977).
88. Federal Hazardous Substances Act of 1960, Pub. L. 86–613, 74 Stat. 372, 15 U.S.C. §§ 1261–73 (as amended).
89. 42 Fed. Reg. 18850, 18853 (1977).
90. *American Apparel Manufacturers Association* v. *Consumer Product Safety Commission*, No. 77–682 (D.D.C. May 3, 1977), *vacated* No. 77–1407 (D.C. Cir. May 19, 1977).
91. 42 Fed. Reg. 22878 (1977).
92. *Spring Mills, Inc.* v. *Consumer Product Safety Commission*, No. 77–891 (D.S.C. June 23, 1977) (preliminary injunction granted); *pending*, Nos. 77–1969 and 77–1970 (4th Cir., August 11, 1977).
93. 42 Fed. Reg. 13546–48 (1977).
94. U.S. Department of Health, Education, and Welfare, National Institute of Occupational Safety and Health, *Current Intelligence Bulletin: Acrylonitrile*, July 1, 1977.
95. 42 Fed. Reg. 13562–65 (1977).
96. Joint FAO/WHO Food Standards Programme, Codex Committee on Food Additives, 10th Session, The Hague, June 2–7, 1975, *Food Additives in Soft Drinks*, cited in 42 Fed. Reg. 13548 (1977).
97. 42 Fed. Reg. 48527 (1977).
98. Lead-Based Paint Poisoning Prevention Act of 1971, Pub. L. 91–695, 84 Stat. 2078, 42 U.S.C. §§ 4801, 4811, 4821, 4831, 4841–4843 (1971), *as amended by* Pub. L. 93–151, 87 Stat. 565 (1973), *as amended by* Pub. L. 94–317, 90 Stat. 705 (1976).
99. Lead-Based Paint Poisoning Prevention Act Amendments of 1976, Pub. L. 94–317, 90 Stat. 706, 42 U.S.C. § 4841.
100. 42 Fed. Reg. 9404 (1977).
101. 42 Fed. Reg. 44193 (1977).
102. *Reserve Mining Company* v. *Minnesota Pollution Control Agency*, No. 05598 (Minn. Dist. Ct. January 28, 1977).

103. *United States* v. *Reserve Mining Company*, No. 5–72–19 (D. Minn. July 7, 1976).
104. *Reserve Mining Company* v. *Herbst*, No. 47528 (Minn. Sup. Ct. May 27, 1977).
105. *United States* v. *Reserve Mining Company*, 431 F. Supp. 1248 (D. Minn. 1977).
106. *Marshall* v. *Barlow's, Inc.*, 424 F. Supp. 437 (D. Idaho 1976); *vacated*, — U.S. —, 97 S. Ct. 776 (partial stay of injunction as it affected persons other than respondent); *prob. juris noted*, 45 U.S.L.W. 3690 (1977).
107. *U.S.* v. *FMC Corp.*, No. 77-3061 (S.D. W. Va., March 15, 1977).
108. Federal Water Pollution Control Act of July 17, 1952, Pub. L. 82–579, ch. 927, 66 Stat. 755, 33 U.S.C. § 1160.
109. Safe Drinking Water Act of 1974, Pub. L. 93–523, 88 Stat. 1660, 42 U.S.C. § 300i (1974).
110. Interview with James Manwaring, Office of Water Supply, U.S. Environmental Protection Agency, October 3, 1977.

AIR

111. Pub. L. 95-95, 91 Stat. 685, 42 U.S.C. § 7401, *et seq.*
112. § 201.
113. § 213.
114. § 201.
115. U.S. Environmental Protection Agency, Office of Air Programs, "Interim Report on the Restorative Maintenance Program for 1975–76 Model Year Vehicles," February 1977, Table 4.
116. U.S. Environmental Protection Agency, Office of Research and Development, *The Los Angeles Catalyst Study Symposium*, EPA 600/1–77–034 (Research Triangle Park, N.C., 1977).
117. § 212.
118. § 219.
119. § 209.
120. § 224.
121. § 222.
122. § 127.
123. *Ibid.*
124. § 128.
125. "U.S. Environmental Protection Agency Interpretative Ruling for Implementation of the Requirements of 40 CFR 51.18," October 12, 1976, in *Environment Reporter* 7:939–42 (1976).
126. § 129.
127. § 108.
128. § 118.
129. § 307.
130. §§ 311, 403.
131. § 118.
132. § 117.
133. § 107.
134. § 118.
135. David W. Tundermann, "Economic Enforcement Tools for Pollution Control: The Connecticut Plan," presented at the Environmental Study Conference Briefing, "Tax and Fee Approaches to Pollution Control," Washington, D.C., May 26, 1976, available from the Council on Environmental Quality.
136. § 109.
137. § 123.
138. § 116.

139. § 120.
140. § 106.
141. § 313.

WATER

142. Federal Water Pollution Control Act Amendments of 1972, Pub. L. 92–500, 86 Stat. 816, 33 U.S.C. § 1251(a)(1).
143. *Id.* § (a)(1)(B).
144. U.S. Environmental Protection Agency, Office of Planning and Management, Office of Resources Management, Grants Administration Division, "Activities of the Grants Assistance Programs," September 1977, Table C-120-M, p. 18.
145. 122 Cong. Rec. S. 17696 (daily ed. Oct. 1, 1976) (remarks of Sen. Baker).
146. Pub. L. 94-558, 90 Stat. 2639, 33 U.S.C. § 1293.
147. Supplemental Appropriations Act, 1977, Pub. L. 95–26, 91 Stat. 69.
148. Public Works Employment Appropriations Act of 1976, Pub. L. 94-447, 90 Stat. 1497, 42 U.S.C. §§ 6722-24, 6730 (1976).
149. U.S. Environmental Protection Agency, Office of Water Program Operations, *Cost Estimates for Construction of Publicly-Owned Wastewater Treatment Facilities—1976 Needs Survey: Report to Congress* (Washington, D.C., February 10, 1977), EPA-430/9-76-010 (MCD-48A).
150. *Ibid.*
151. Council on Environmental Quality, *Environmental Quality—1975, The Sixth Annual Report of the Council on Environmental Quality* (Washington, D.C.: Government Printing Office, 1975), p. 70.
152. 40 CFR, Part 35, Subpart E, Appendix A, and proposed amendments, 42 Fed. Reg. 6841–44 (1977).
153. Comptroller General of the United States, *Better Data Collection and Planning Is Needed To Justify Advanced Waste Treatment Construction* (Washington, D.C., 1976), CED–77–12, Chapter 3.
154. EPA 1976 Needs Survey, *supra* note 149, at Table 8; MCD 48B, Table 21.
155. U.S. Environmental Protection Agency, Municipal Construction Division, Office of Water Program Operations, *Clean Water Fact Sheet,* July 15, 1977, p. 4.
156. Russell E. Train, Administrator, U.S. Environmental Protection Agency, "Encouraging Less Costly Wastewater Facilities for Small Communities," Memorandum to the Regional Administrators, December 30, 1976.
157. Walter G. Gilbert, "Relation of Operation and Maintenance to Treatment Plant Efficiency," *Water Pollution Control Federation Journal* 48:1832 (1976); Comptroller General of the United States, *Improvements Needed in Operating and Maintaining Waste Water Treatment Plants* (Washington, D.C., 1976), LCD–76–12, pp. 9–12.
158. *Id.* Chapter 2.
159. U.S. Environmental Protection Agency, Municipal Construction Division, Office of Water Program Operations, *Clean Water Fact Sheet,* July 15, 1977, p. 7.
160. Thomas C. Jorling, Assistant Administrator for Water and Hazardous Materials, U.S. Environmental Protection Agency, *Hearings Before the Senate Subcommittee on Environmental Pollution of the Committee on Environment and Public Works,* Part 9, June 30, 1977, 95th Cong., 1st Sess. (Washington, D.C.: Government Printing Office, 1977).
161. U.S. Environmental Protection Agency, *EPA Enforcement: A Progress Report, Air, Noise, Pesticides, Water* (Washington, D.C.: Government Printing Office, 1977), pp. 52–53.

162. "Survey Predicts 33 Percent Municipal Compliance with 1977 Deadline," *Water Pollution Control Federation Journal* 49:360 (1977).

163. U.S. Environmental Protection Agency, Office of Enforcement, "Memoranda on Enforcing Statutory 'July 1, 1977,' Water Pollution Requirements," June 3, 1977, in *Environment Reporter* 8:247–50 (1977).

164. U.S. Supreme Court, No. 75-978, decided February 23, 1977. This decision also resolved differences among the Courts of Appeals regarding the proper form in which to review effluent limitation guidelines, holding that the Court of Appeals, rather than the District Court, has exclusive jurisdiction.

165. U.S. Environmental Protection Agency, Office of Water Program Operations, Municipal Construction Division, *Federal Guidelines—State and Local Pretreatment Programs,* Vol. I (Washington, D.C., January 1977), EPA-430/9-76-017a.

166. 42 Fed. Reg. 5986 (1977).

167. 42 Fed. Reg. 2588, 2622 (1977); 42 Fed. Reg. 5975 (1977).

168. *Natural Resources Defense Council* v. *Train,* No. 75–172, 8 ERC 2120 (D.D.C. June 9, 1976).

169. The Pike's Peak Area Council of Governments, "The Areawide Water Quality Management Plan for El Paso and Teller Counties," submitted to the state of Colorado August 5, 1976; adopted February 7, 1977.

170. Memorandum from Andrew W. Breidenbach, Assistant Administrator for Water and Hazardous Materials, and Roger Strelow, Assistant Administrator for Air and Waste Management, U.S. Environmental Protection Agency, to EPA Regional Administrators, November 15, summarized in *Environment Reporter* 7:1133 (1976).

171. U.S. Department of Transportation, Office of Environmental Affairs, and U.S. Environmental Protection Agency, Assistant Administrator for Water and Hazardous Materials, "Joint Memorandum of Planning and Program Coordination between U.S. DOT and U.S. EPA," July 12, 1976.

172. U.S. Environmental Protection Agency, "Interim Report of the Nonpoint Source Water Pollution Working Group," November 9, 1976.

173. 42 Fed. Reg. 6846 (1977).

174. EPA Interim Report, *supra* note 172, at Table 2-1.

175. Pub. L. 94-305, 90 Stat. 663, 15 U.S.C. § 694 (1976).

176. *U.S.* v. *City of Camden,* No. 76-0424 (D.N.J. July 7, 1976).

177. Comptroller General of the United States, *Problems and Progress in Regulating Ocean Dumping of Sewage Sludge and Industrial Wastes: Report to Congress* (Washington, D.C., 1977), CED-77-18.

178. Thomas C. Jorling, *supra* note 160.

179. *Ibid.*

180. EPA 1976 Needs Survey, *supra* note 149.

181. Proposed Amendment to Section 204, Federal Water Pollution Control Act, submitted by Douglas Costle, Administrator, U.S. Environmental Protection Agency, July 12, 1977.

SOLID WASTES

182. Pub. L. 94-580, 90 Stat. 2795, 42 U.S.C. § 6901 (1976).

183. E. Lazar, R. Testani, and A. Giles, U.S. Environmental Protection Agency, "The Potential for National Health and Environmental Damages from Industrial Residue Disposal," presented at the National Conference on Disposal of Residues on Land, September 15, 1976.

184. Pub. L. 92-500, 86 Stat. 816–903, 33 U.S.C. § 1251 *et seq.* (1972).

185. U.S. Environmental Protection Agency, Office of Solid Waste Management Programs, *Disposal of Hazardous Wastes: Report to Congress* (Washington, D.C.: Government Printing Office, 1974).

186. Foster D. Snell, Inc., *The Potential for Capacity Creation in the Hazardous Waste Management Service Industry*, prepared for the U.S. Environmental Protection Agency under Contract No. 68-01-3266 (Springfield, Va.: National Technical Information Service, 1976), PB-257 187, p. x, updated by Tim Fields, U.S. Environmental Protection Agency, Office of Solid Waste Management, May 1977.

187. Barr Enginering Co., *Chemical Waste Land Disposal Facility Demonstration Grant Application*, and interim report, prepared for the Minnesota Pollution Control Agency under EPA demonstration Grant No. S803744 (Springfield, Va.: National Technical Information Service, 1975), pp. 1–2.

188. "Waste Age Survey of the Nation's Disposal Sites," *Waste Age*, January 1977, p. 26.

189. Information supplied by John Skinner, U.S. Environmental Protection Agency.

190. National Commission on Supplies and Shortages, *Government and the Nation's Resources* (Washington, D.C.: Government Printing Office, 1976), p. 166.

191. 41 Fed. Reg. 41202 (1976).

192. U.S. Department of the Interior, press release, July 5, 1977.

193. 41 Fed. Reg. 16950 (1976).

194. Information provided by John Heffelfinger, Office of Solid Waste, U.S. Environmental Protection Agency.

NOISE

195. U.S. Environmental Protection Agency, Office of Noise Abatement and Control, *Toward a National Strategy for Noise Control* (Washington, D.C.: Government Printing Office, 1977).

196. *Id.* p. 1.

197. U.S. Department of Transportation, Federal Aviation Administration, "FAA Issues Noise Regulations for Older Jets," press release 76-121, September 28, 1976.

198. U.S. Congress, House, *Airport and Airway Development Act Amendments of 1976*, H.R. 9771, 94th Cong., 2d Sess., 1976.

199. U.S. Department of Transportation, Federal Aviation Administration, "Study—The Feasibility, Practicability and Cost of the Soundproofing of Schools, Hospitals, and Public Health Facilities Located Near Airports," Report to Congress, July 1977.

200. U.S. Department of Transportation, Federal Aviation Administration, Environmental Impact Statement, "Noise Regulation and Type Certification Alternatives for Civil Supersonic Aircraft" (draft, April 18, 1977).

201. U.S. Department of Transportation, Federal Aviation Administration, *Monitoring of Concorde Operations at Dulles International Airport during April 1977*, May 10, 1977.

202. *British Airways Board* v. *Port Authority of New York and New Jersey*, No. 77-7237, 7 ELR 20512 (2d Cir., 1977).

ENERGY

203. U.S. Department of the Interior, Bureau of Mines, "Annual U.S. Energy Use Up in 1976," news release, March 14, 1977.

204. Pub. L. 95-2, 91 Stat. 4, 15 U.S.C. § 717 note (1977).

205. Executive Office of the President, Energy Policy and Planning, *The National Energy Plan* (Washington, D.C.: Government Printing Office, 1977), p. vii.
206. *Weekly Compilation of Presidential Documents* 13:782 (May 30, 1977).
207. Council on Environmental Quality, *OCS Oil and Gas—An Environmental Assessment*, Vol. 1 (Washington, D.C.: Government Printing Office, 1974).
208. Pub. L. 83-212, 67 Stat. 462, 43 U.S.C. §§ 1331-1343.
209. H.R. 6218; S. 521; C.R. 521, 94th Cong., 2d Sess. (1976).
210. U.S Department of the Interior, press release, May 25, 1977.
211. U.S. Department of the Interior, "Revised OCS Planning Schedule Announced," press release, May 17, 1977.
212. *New York* v. *Kleppe*, 9 ERC 1798 (E.D. N.Y. 1977).
213. Department of the Interior, press release, May 25, 1977.
214. "Oil Pollution of the Oceans, The President's Message to the Congress Recommending Measures To Control the Problem," March 17, 1977, *Weekly Compilation of Presidential Documents* 13:408 (1977); see also Appendix B.
215. *Ibid.*
216. 42 Fed. Reg. 24868-24876 (1977).
217. U.S. Federal Energy Administration, "An Executive Summary of an Analysis of the Alternatives Available for the Transportation and Disposition of Alaskan North Slope Crude Oil," *Federal Energy News*, November 30, 1976.
218. *Id.* pp. 14–17.
219. Thomas Brown and Cheryl Clark, "Clean Air?" *New York Times Magazine*, October 17, 1976, p. 34.
220. Pub. L. 94-586, 90 Stat. 2903, 15 U.S.C. § 719 (1976).
221. Statement by the President on Nuclear Power Policy, Office of the White House Press Secretary, October 28, 1976.
222. Statement by the President on Nuclear Power Policy, Office of the White House Press Secretary, April 7, 1976.
223. The President's Energy Message, Office of the White House Press Secretary, April 20, 1977.
224. *The National Energy Plan*, *supra* note 205, pp. 70–71.
225. Conference on Public Policy Issues in Nuclear Waste Management, Chicago, October 27–29, 1976.
226. *Nucleonics Week* 18(20):2 (1977).
227. Federal Energy Administration, *U.S. Commercial Nuclear Power: A Status Report* (Washington, D.C.: Government Printing Office, 1977), FEA/B-77/390, p. 1.
228. "Current Developments," *Environment Reporter* 7:986 (1976).
229. Ann MacLachlan, "Nuclear Power Sweeps Six States; But Help for Missouri Utilities Fails," *The Energy Daily* 4(100):3 (1976).
230. *New York Times*, March 28, 1977, p. 18.
231. *Nucleonics Week* 18(18):11 (1977).
232. "Current Developments," *Environment Reporter* 8:307 (1977).
233. Nuclear Regulatory Commission, press release 77-8, January 21, 1977.
234. Nuclear Regulatory Commission, press release 77-30, February 22, 1977.
235. Nuclear Regulatory Commission, press release 77-112, June 8, 1977.
236. *NRDC* v. *NRC*, Docket 74-1385 and 74-1856 (C.A. D.C. July 21, 1976.)

237. U.S. Nuclear Regulatory Commission, "General Statement of Policy," 41 Fed. Reg. 34707 (1976).

238. U.S. Nuclear Regulatory Commission, Office of Material Safety and Safeguards, *Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle, A Task Force Report* (Springfield, Va.: National Technical Information Service, 1976).

NATURAL RESOURCES

239. Pub. L. 94–579, 90 Stat. 2743 (codified in scattered sections of 7, 10, 16, 22, 25, 30, 33, 40, 43, 48, and 49 U.S.C.) (1976).

240. Pub. L. 94–588, 90 Stat. 2949 (codified in scattered sections of 16 U.S.C.) (1976).

241. Pub. L. 94–579.

242. Pub. L. 94–588.

243. U.S. Department of Agriculture, Forest Service, *The Outlook for Timber in the United States*, Forest Resource Report No. 20 (Washington, D.C.: Government Printing Office, 1973), p. 8.

244. Pub. L. 94–458, 90 Stat. 1940, 16 U.S.C. § 1(a)–5 (1976).

245. Pub. L. 94–545, 90 Stat. 2517, 16 U.S.C. § 431 (1976).

246. Pub. L. 94–393, 90 Stat. 1197, 16 U.S.C. § 461 (1976).

247. Pub. L. 94–578, § 319, 90 Stat. 2738, 16 U.S.C. §§ 430 j-p (1976).

248. Pub. L. 90–545, 82 Stat. 931, 16 U.S.C. § 79 (1968).

249. U.S. Congress, House, *A Bill To Amend the Act of October 2, 1968, An Act to Establish a Redwood National Park in the State of California*, H.R. 3813, 95th Cong., 1st Sess., 1977.

250. U.S. Department of the Interior, Office of the Secretary, "Andrus Proposes Endangered Redwood National Park," news release, April 19, 1977; Administration draft bill transmitted to Morris Udall, Chairman, Committee on Interior and Insular Affairs, U.S. House of Representatives.

251. Pub. L. 92–203, 85 Stat. 688, 43 U.S.C. §§ 1601–1627 (1971).

252. U.S. Department of the Interior, Bureau of Outdoor Recreation, *Federal Recreation Area Visitation Report—1975* (Washington, D.C., 1976).

253. U.S. Department of the Interior, Bureau of Outdoor Recreation, "Federal Recreation Area Visitation Report—1976," preliminary report, June 1977.

254. U.S. Department of the Interior, Office of the Secretary, "New Conservation Fund Act Could Make $10.8 Billion Available for Recreation," news release, September 30, 1976.

255. Pub. L. 95–42, 91 Stat. 210–212, 16 U.S.C. §§ 460(l)4–9 and 42 U.S.C. § 4001 (1977).

256. Council on Environmental Quality, *Environmental Quality—1976, The Seventh Annual Report of the Council on Environmental Quality* (Washington, D.C.: Government Printing Office, 1976), p. 287.

257. U.S. Department of the Interior, "A Preliminary Urban Parks Study," January 19, 1977, pp. 45–48. The Department of the Interior is now conducting a more comprehensive study of urban recreation needs, problems, and opportunities in accordance with a recent congressional mandate (Pub. L. 94–422, 90 Stat. 1318–19, 16 U.S.C. §§ 4601–10d). The study, to be completed in late 1977, will identify ways to improve close-to-home delivery of recreation service, to preserve metropolitan open space, and to provide environmental education and cultural opportunities.

258. Pub. L. 90–543, 82 Stat. 919, 16 U.S.C. § 1241 *et seq.*

259. U.S. Department of the Interior, Bureau of Outdoor Recreation, memorandum, "Listing of 14 Trail Routes Designated for Study in the National Trails Systems Act, P.L. 94–543," February 11, 1977.

260. "The Environment: The President's Message to the Congress," *Weekly Compilation of Presidential Documents* 13:782 (1977); see also Appendix A.

261. *Id.* p. 791.

262. Pub. L. 94–527, 90 Stat. 2481, 16 U.S.C. § 1244 (1976).

263. Information supplied by the U.S. Department of the Interior, Bureau of Outdoor Recreation.

264. Information supplied by Larry Young, Division of Recreation, Bureau of Land Management, U.S. Department of the Interior.

265. Motorcycle Industry Council, Inc., *1976 Estimated Motorcycle Population and Usage* (Newport Beach, Calif., 1977); information supplied by John Wetzel, Legislative Analyst, Motorcycle Industry Council.

266. Information supplied by the International Snowmobile Industry Association.

267. H. R. Wilshire, "Study Results of 9 Sites Used by ORV's That Illustrate Land Modification," prepared for the Council on Environmental Quality, April 9, 1977, p. 1.

268. *Id.* p. 12.

269. The Geological Survey of America, Committee on Environment and Public Policy, *Impacts and Management of Off-Road Vehicles* (Boulder, 1977), pp. 3–7.

270. 42 Fed. Reg. 26959 (1977).

271. Executive Order No. 11644, 37 Fed. Reg. 2877 (1972).

272. Material in this section is based on the Report of the 29th Meeting of the International Whaling Commission, held in Canberra, Australia, June 1977, to be published in 1978 by the Commission.

273. Curtis Bohlen, Chief, U.S. Delegation, "Report of the U.S. Delegation to the Conference of the Parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora," 1976.

274. 419 F. Supp. 753 (E.D. Tenn. 1976).

275. Information supplied by Bruce McBride, Office of Endangered Species, Department of the Interior, June 20, 1977.

276. Letter from the Office of Endangered Species, Fish and Wildlife Service, to Robert Thornton, Counsel for the Subcommittee on Fisheries and Wildlife Conservation and the Environment, Committee on Merchant Marine and Fisheries, U.S. House of Representatives, April 1977; written statement of Robert L. Herbst, Assistant Secretary for Parks and Wildlife, before the Subcommittee on Resource Protection on the Endangered Species Act of 1973, Environment and Public Works Committee, U.S. Senate, Oversight Hearings, July 20, 1977.

277. Pub. L. 94–352, 90 Stat. 870, 16 U.S.C. § 1132 (1976); Pub. L. 94–357, 90 Stat. 905, 16 U.S.C. § 1132 (1976); Pub. L. 94–557, 90 Stat. 2633, 16 U.S.C. § 1132 (1976); Pub. L. 94–567, 90 Stat. 2692, 16 U.S.C. § 1132 (1976).

278. Pub. L. 94–579, 90 Stat. 2785, 43 U.S.C. § 1782 (1976).

279. Information supplied by Darrell Lewis, Bureau of Land Management, U.S. Department of the Interior, January 24, 1977.

280. U.S. Department of Agriculture, Forest Service, "National Public Involvement Begins on Inventory of National Forest Roadless Areas," news release, June 16, 1977.

281. "The Environment: The President's Message to Congress," *supra* note 260, at 790.

282. *Ibid.*

283. Wild and Scenic Rivers Act, Pub. L. 90-542, 82 Stat. 906, 16 U.S.C. § 1271 (1968).
284. Pub. L. 94-486, 90 Stat. 2327, 2329, 2330, 16 U.S.C. § 1274 (1976).
285. "The Environment: The President's Message to Congress," *supra* note 260, at 791.
286. Pub. L. 94-407, 90 Stat. 1238, 16 U.S.C. § 1273.
287. Pub. L. 95-87, 91 Stat. 445, 30 U.S.C. § 1201.
288. *Kerr-McGee Chemical Corp.* v. *Kleppe,* — F. Supp. — (D.D.C. 1976).
289. Personal communication with John Farrell, Secretary's Environmental Review Office, and Robert Uram, Solicitor's Office, Division of Energy and Resources, U.S. Department of the Interior, June 21, 1977.
290. Pub. L. 94-429, 90 Stat. 1342, 16 U.S.C. § 1901 (1976).
291. U.S. Department of the Interior, National Park Service, "Parkland Protection Hailed as Park Mining Laws Repealed," news release, October 8, 1976.
292. U.S. Department of Agriculture, Soil Conservation Service, "Extent and Distribution of Prime Farmlands in the U.S.," draft, April 8, 1977.
293. John A. Knebel, Acting Secretary of Agriculture, Secretary's Memorandum No. 1827, Supplement 1, "Statement on Prime Farmland, Range, and Forest Land," June 21, 1976.
294. Council on Environmental Quality, "Analysis of Impacts on Prime and Unique Farmland in Environmental Impact Statements," Memorandum for Heads of Agencies, August 30, 1976.
295. U.S. General Accounting Office, *Report to the Congress: To Protect Tomorrow's Food Supply, Soil Conservation Needs* Priority *Attention,* CED-77-30 (Washington, D.C., 1977), p. 3.
296. Discussed at *id.* p. 6.
297. *Id.* pp. ii, iv.
298. Pub. L. 93-378, 88 Stat. 476, 16 U.S.C. § 1601 (1974).
299. Luther J. Carter, "Soil Erosion: The Problem Persists Despite the Billions Spent on It," *Science* 196:409 (1977).
300. U.S. General Accounting Office, *Report to the Congress: Better Federal Coordination Needed to Promote More Efficient Farm Irrigation,* RED-76-116 (Washington, D.C., 1976).
301. U.S. Geological Survey, *Water Resources Review for May 1977,* pp. 1, 9-11, 13.
302. Joseph Winski, "Western Farmers Fear Cutbacks in Irrigation as Water Supplies Fall," *The Wall Street Journal,* May 31, 1977.
303. "Drought in the Western and Plains States: The President's Message to the Congress Outlining Administrative Actions and Legislative Proposals To Provide Assistance to the Drought Stricken Areas," *Weekly Compilation of Presidential Documents* 13:433 (1977).
304. Laws enacted include Pub. L. 95-18, 91 Stat. 116 (codified in scattered sections of 8, 29, 31, and 42 U.S.C.); Pub. L. 95-31, 91 Stat. 169 (codified in scattered sections of 5 U.S.C. and 42 U.S.C.).
305. "The Environment: The President's Message to the Congress," *supra* note 260, at 788.
306. 42 Fed. Reg. 36788-95 (1977).
307. "Water Resources Projects: The President's Message to the Congress Recommending Deletion of Funds for 19 Projects from the 1978 Fiscal Year Budget," *Weekly Compilation of Presidential Documents* 13:234 (1977).

308. "Water Resource Projects: Statement by the President Announcing His Decision on 32 Projects," *Weekly Compilation of Presidential Documents* 13:557 (1977).

309. Public Works for Water and Power Development and Energy Research Appropriation Act, Pub. L. 95–96, 91 Stat. 797 (1977).

310. "The Environment: The President's Message to the Congress," *supra* note 260, at 788.

311. U.S. Water Resources Council, "Planning and Cost Sharing Policy Options for Water and Related Land Programs" (Washington, D.C., 1975).

312. "Floodplain Management," Executive Order 11988, *Weekly Compilation, supra* note 260, at 803.

313. Executive Order 11296, 3 CFR §§ 571–573.

314. 24 CFR §§ 1909-1920 (1977).

315. "Protection of Wetlands," Executive Order 11990, *Weekly Compilation, supra* note 260, at 806.

316. *Id.* p. 789.

HUMAN SETTLEMENTS

317. Coastal Zone Management Act Amendments of 1976, Pub. L. 94–370, 90 Stat. 1013, 16 U.S.C. § 1451 (1976).

318. U.S. Congress, Senate, *An Act to Establish a Policy for the Management of Oil and Natural Gas in the Outer Continental Shelf . . . ,* S. 9, 95th Cong., 1st Sess., 1977; U.S. Congress, House, *A Bill to Establish a Policy for the Management of Oil and Natural Gas in the Outer Continental Shelf*, H.R. 1614, 95th Cong., 1st Sess., 1977.

319. Pub. L. 66–146, ch. 85, § 35, 41 Stat. 450, 30 U.S.C. 191 (as amended) (1973).

320. Pub. L. 94–377, 90 Stat. 1089, 30 U.S.C. § 191 (1976).

321. Federal Land Policy and Management Act of 1976, Pub. L. 94–579, 90 Stat. 2744, 43 U.S.C. § 1701 (1976).

322. Public Lands-Local Government Funds Act of 1976, Pub. L. 94–565, 90 Stat. 2662, 31 U.S.C. §§ 1601–1607 (1976).

323. Public Land Law Review Commission, *One Third of the Nation's Land: A Report to the President and the Congress by the Public Land Law Review Commission* (Washington, D.C., 1970).

324. U.S. Congress, House, Committee on Banking, Finance, and Urban Affairs, *Ninth Annual Report on the National Housing Goal—Message from the President*, H. Doc. 93–53, 95th Cong., 1st Sess. (Washington, D.C.: Government Printing Office, 1977), p. 8.

325. Housing and Community Development Act of 1974, Pub. L. 93–383, § 107, 88 Stat. 647, 42 U.S.C. § 5307 (1974).

326. U.S. Congress, House, *supra* note 324.

327. Supplemental Housing Authorization Act of 1977, Pub. L. 95–24, 91 Stat. 55 (1977).

328. Tax Reform Act of 1976, Pub. L. 94–455, 90 Stat. 1520, 26 U.S.C. § 1 *et seq.* (1976).

329. Public Buildings Cooperative Use Act of 1976, Pub. L. 94–541, 90 Stat. 2505, 40 U.S.C. §§ 490, 601(a), 606, 611, 612(a) (1976).

330. Supplemental Appropriations Act of 1977, Pub. L. 95–26, 91 Stat. 61 (1977).

331. Railroad Revitalization and Regulatory Reform Act of 1976, Pub. L. 94–210, 90 Stat. 31 (codified in scattered sections of 15, 31, 45, and 49 U.S.C.) (1976).

332. Amtrak Improvement Act of 1974, Pub. L. 93–496, 45 U.S.C. 501 (1974).

333. Pub. L. 94–462, 90 Stat. 1971, 20 U.S.C. § 951 (1976).

334. Land and Water Conservation Fund Act Amendments of 1976, Title II—National Historic Preservation Fund, Pub. L. 94–422, 90 Stat. 1319, 16 U.S.C. § 470 (1976).

335. Pub. L. 94–369, 90 Stat. 999 (codified in scattered sections of 33 and 42 U.S.C.) (1976).

336. Public Works Employment Act of 1977, Pub. L. 95–28, 91 Stat. 116–120 (1977).

337. Pub. L. 95–93, 91 Stat. 627 (1977).

338. The President's Environmental Message Fact Sheet, *The President's Environmental Program—1977*, compiled by the Council on Environmental Quality (Washington, D.C.: Government Printing Office, 1977), p. FS–40.

339. Federal Water Pollution Control Act Amendments of 1972, Pub. L. 92–500, § 208, 86 Stat. 816, 33 U.S.C. § 1251 *et seq.* (1972).

340. Public Works and Economic Development Act of 1965, Pub. L. 89–136, as amended, 79 Stat. 552, 42 U.S.C. § 3121.

341. Land and Water Conservation Fund Act of 1965, Pub. L. 88–578, as amended, 16 U.S.C. § 4601–8.

342. Commission on Federal Paperwork, *Environmental Impact Statements* (Washington, D.C.: Government Printing Office, 1977), p. 45.

343. *Ibid.*

344. Coastal Zone Management Act of 1972, Pub. L. 92–583, 86 Stat. 1280, 16 U.S.C. § 1451 (1972) (as amended).

345. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, "Federal Consistency with Approved Coastal Management Programs: Proposed Policies and Procedures," 42 Fed. Reg. 43586–610 (1977).

346. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Impact Statement, "California Coastal Zone Management Program" (draft, 1976), and comments by the Western Oil and Gas Association, p. 1.

347. Federal Highway Act Appropriation of 1976, Pub. L. 94–280, 90 Stat. 425 (codified in scattered sections of 16, 23, 26, and 49 U.S.C.) (1976).

348. Federal-Aid Highway Act of 1973, Pub. L. 93–87, 87 Stat. 253, 255–278, 280–282 (codified in scattered sections of 23, 33, and 49 U.S.C.) (1973).

349. Urban Mass Transportation Act of 1964, Pub. L. 88–365, 78 Stat. 302, 49 U.S.C. § 1601 *et seq.* (1964).

GLOBAL ENVIRONMENT

350. Pub. L. 94–265, 90 Stat. 331 (codified in scattered sections of 16 and 22 U.S.C.) (1976).

351. "Oil Pollution of the Oceans: The President's Message to the Congress Recommending Measures To Control the Problem," March 17, 1977, *Weekly Compilation of Presidential Documents* 13:408–409; see also Appendix B.

352. P. A. Moisev, "Some Aspects of Commercial Utilization of the Antarctic *Euphausia* Resources," *Abstracts of Symposium on Antarctic Ecology*, Cambridge, England, July 29–August 2, 1968.

353. Organization for Economic Cooperation and Development, Final Report of the Cooperative Technical Program to Measure the Long Range Transport of Air Pollutants (Paris: Organization for Economic Cooperation and Development, 1977).

354. Report of the Governing Council of the United Nations Environment Programme on the Work of its Fifth Session held at UNEP Headquarters, Nairobi from 9 to 25 May 1977, UNEP/GC/106, June 20, 1977, p. 9.

355. United Nations Environment Programme, "Report of Sessional Committee 1," Governing Council, Fifth Session, Nairobi, 9–25 May 1977, UNEP/GC/L.50, May 23, 1977.

356. "The Environment: The President's Message to the Congress," *Weekly Compilation of Presidential Documents* 13:782 (1977); see also Appendix A).

357. Pub. L. 95–88, 91 Stat. 533–538 (1977), adding Section 118 to the Foreign Assistance Act of 1961.

358. Statement by the President on Nuclear Power Policy, Office of the White House Press Secretary, April 7, 1977.

NEPA

359. *Weekly Compilation of Presidential Documents* 13:782 (1977); see also Appendix A.

360. Executive Order No. 11991, 42 Fed. Reg. 26967 (1977), amending Executive Order 11514 (1970).

361. Executive Order 11514; see also Appendix A.

362. Statement by Senator Harrison H. Schmitt (New Mexico), Public Hearings To Receive Testimony on the National Environmental Policy Act Before the Council on Environmental Quality, June 8, 1977.

363. Statement by Warren Buhler, *id.*, June 6, 1977.

364. Commission on Federal Paperwork, *Environmental Impact Statements* (Washington, D.C.: Government Printing Office, 1977).

365. Statement by Roy J. Kirk, CEQ Hearings, *supra* note 362, June 6, 1977; U.S. General Accounting Office, *The Environmental Impact Statement—It Seldom Causes Long Project Delays But Could Be More Useful If Prepared Earlier* (Washington, D.C.: Government Printing Office, 1977), CED 77–99.

366. Pub. L. 91–604, § 12(a), 84 Stat. 1709, 42 U.S.C. 1857h–7.

367. 427 U.S. 390 (1976).

368. 542 F.2d 364, 9 ERC 1086 (7th Cir., 1976).

369. *Kleppe* v. *Sierra Club*, *supra* note 367, p. 407 n. 16, p. 414 n. 26.

370. *Natural Resources Defense Council* v. *Nuclear Regulatory Commission*, 539 F.2d 824 (2d Cir., 1976), *cert. granted sub nom.*, *Allied-General Nuclear Services* v. *NRDC*, 45 U.S.L.W. 3647 (1977).

371. *Minnesota Public Interest Research Group* v. *Butz*, 541 F.2d 1292 (8th Cir., 1976), *cert. denied*, 45 U.S.L.W. 3601.

372. *United Family Farmers, Inc.* v. *Kleppe*, 418 F. Supp. 591 (D.S.D., 1976).

373. *Conservation Law Foundation* v. *G.S.A.*, 427 F. Supp. 1369 (D.R.I., 1977).

374. *Natural Resources Defense Council* v. *Nuclear Regulatory Commission*, 547 F.2d 633 (D.C. Cir., 1976), *cert. granted sub nom.*, *Vermont Yankee Power Corp.* v. *NRDC*, 45 U.S.L.W. 3554 (1977).

375. 547 F.2d 639 n. 12.

376. *Aeschliman* v. *Nuclear Regulatory Commission*, 547 F.2d 1109 (D.C. Cir., 1976), *cert. granted sub nom.*, *Consumers Power Co.* v. *Aeschliman*, 45 U.S.L.W. 3554 (1977).

377. *Calvert Cliffs Coordinating Commitee* v. *Atomic Energy Commission*, 449 F.2d 1109 (D.C. Cir., 1971).

378. See *EDF* v. *Corps of Engineers* (5th Cir., 1974), *Conservation Council* v. *Froehlke* (4th Cir., 1973); *Sierra Club* v. *Froehlke* (7th Cir., 1973), *EDF* v. *Corps of Engineers* (8th Cir., 1972); and *Calvert Cliffs Coordinating Committee* v. *AEC* (D.C. Cir., 1971).

379. Federal and state courts look to judicial interpretation of NEPA to help construe state acts patterned on NEPA. *City of Davis* v. *Coleman*, 521 F.2d 661, 672 (9th Cir., 1975); *Friends of Mammoth* v. *Mono County*, 8 Cal. 3d 247, 260–61, 104 Cal. Rptr. 761, 769–770, 502 P.2d 1049, 1057–1058 (Cal. S.C. 1972); *Eastlake Community Council* v. *Roanoke Assoc., Inc.*, 513 P.2d 36, 44–45 (Wash. S.C. 1973); *Wisconsin's Environmental Decade* v. *P.S.C.*, 230 N.W.2d 243, 248 (Wisc. S.C. 1975). Federal reliance upon judicial construction of state NEPA's would appear equally applicable in NEPA litigation.

380. 8 Cal. 3d 247, 263 n.8, 104 Cal. Rptr. 761, 502 P.2d 1049 (Cal. S.C. 1972).

381. 45 Cal. App. 3d 322, 119 Cal. Rptr. 568 (Cal. Ct. of App. 1975).

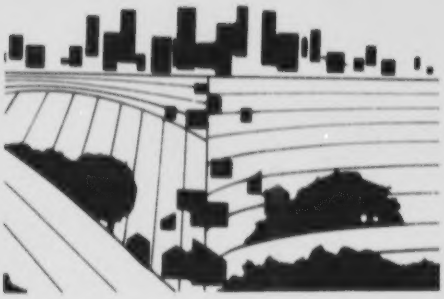
382. Also see *Eastlake Community Council* v. *Roanoke Associates*, 513 P.2d 36 (Wash. S.C. 1973); *Juanita Bay Valley Cons. Ass'n* v. *City of Kirkland*, 510 P.2d 1140 (Wash. Ct. of App. 1973).

383. Pub. Res. Code §§ 21002, 21002.1, 21081.

384. New York Environmental Conservation Law § 8-0109, subds. 1 and 9.

385. Council on Environmental Quality, "Community Development Block Grants and NEPA," prepared for the Committee on Merchant Marine and Fisheries, U.S. House of Representatives, 1977 (available from CEQ).

CHAPTER 2



CONDITIONS AND TRENDS

AIR QUALITY

Based on the levels of the five major "criteria" pollutants* present in the air, the nation's air quality is improving. Although nearly all large cities are still experiencing violations of some standards, particularly for oxidants and carbon monoxide, indications are that with aggressive control programs for all sources of hydrocarbons in cities with severe oxidant problems, most of these cities can meet the ambient standards for these pollutants.

Only the south coast basin of California, the Houston-Galveston area, and Philadelphia are likely to be significantly above the ambient ozone standard in 1990. Five other cities are projected to have a marginal problem in terms of the number of days the ambient standard is exceeded. In the California region, a significant improvement is expected. Its large population, heavy dependence on the automobile, and extremely adverse geographic and climatic conditions have created the worst oxidant problem in the United States and hence a most difficult smog control problem. Heavy concentration of petroleum and petrochemical industries is responsible for most of the oxidant pollution in the Houston-Galveston area. Because growth rates of these industries are expected to be high and because control capability is uncertain, attainment of the oxidant standard by

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*The criteria pollutants, subject to primary standards established to protect human health, are: sulfur oxides, total suspended particulates, carbon monoxide, photochemical oxidants, and nitrogen dioxide.

1990 does not appear likely. In Philadelphia the problem involves both motor vehicles and industry. Air pollution control in these regions requires judicious growth policies and strong enforcement of industrial emissions limitations.

Rapid conversion to use of coal has the potential for worsening air pollution, both globally and locally, and must be carefully watched. A global increase of carbon dioxide levels is to be expected with burning more fossil fuels; the attendant effects on climate must be regarded as a serious environmental threat. Acid rain caused by sulfur oxides and nitrogen oxides emissions can adversely affect large subglobal areas, as is evident in Scandinavia. Current data point to similar potential impacts in the United States.

Scrubbers and particulate control systems can substantially reduce local effects of sulfur dioxide and particulates, but rapid growth and heavy use of coal regionally may create serious air quality problems that are not covered by the present standards for criteria pollutants. Extensive use of coal, either by direct combustion or in conversion technologies such as liquefaction or gasification, could lead to increased emissions of sulfates, nitrates, trace metals, and organic carcinogenic pollutants. To ensure safe use of coal on a large scale, we must assess the impact of these pollutants and of possible control measures. The Administration has emphasized these issues in the National Energy Plan [1] and research programs that are underway.

URBAN AIR QUALITY

Carbon monoxide and photochemical oxidants are the main air pollution problems in most U.S. cities. The Pollutant Standards Index (PSI), developed by a federal interagency task force last year,[2] is used here to show air quality in 20 cities on a uniform basis. By comparing PSI values among the urban regions, we can see where the air pollution problems are and the pollutants causing the problems. Los Angeles emerges, not unexpectedly, as the city with the worst air quality—with index values in the "unhealthful," "very unhealthful" or "hazardous" range for 318 days in 1975. Nine other cities had index readings above 100 for more than 100 (but less than 200) days for the year.

The PSI for 1 day rises above 100 when any one of the five criteria pollutants reaches a level judged to have adverse effects on human health. The relationships of index values, measured concentrations of pollutants, and health effects, are shown in Table 1.

Daily PSI values for 20 cities in 1975 are shown in Figure 1. For example, in Los Angeles, there were 8 days of "hazardous" air quality conditions (PSI above 300), 190 additional days of "very unhealthful" conditions (PSI 200–300), 120 days of "unhealthful" conditions (PSI 100–200), and 97 days in the "moderate" and "good" range (PSI 0–100). The figures beside each diagram show the responsible pollutants and the number of days air quality was harmful to human health.

Carbon monoxide and ozone are clearly the predominant causes of high index values in most large U.S. cities. Each is mainly caused by emissions from motor vehicles, although stationary sources of hydrocarbons are significant contributors to photochemical smog formation in some cities.

In addition to the oxidant and carbon monoxide problems of major cities, some small towns such as Steubenville, Ohio, which are adjacent to major, yet uncontrolled, industrial polluters, also show high annual PSI values. The pollutants here are usually particulates and sulfur dioxide.

HEALTH RISKS

Air quality data from a single station in an urban region give little indication of the number of people affected by air pollution. One improvement is to display all available data by location within an urban region. A more sophisticated approach involves estimates of each pollutant's impacts considering the population at risk, population movement within a city and residential and employment density in addition to air quality data within the region. This approach is the most precise, but it requires more data, some of which may not be available currently.

The spatial distribution of ambient levels of a pollutant can be shown on city population density maps. The number and magnitude of violations of the air quality standard for a given pollutant can then be annotated for each monitoring station. Examples of these air quality impact maps for ozone and CO are given in Figure 2.

CO impacts downtown areas where population and traffic densities are high; in contrast, the maximum ozone impact is in the suburbs. The reason is that the sun's chemical transformation of hydrocarbons and nitrogen oxide emissions into ozone takes time, generally occurring some 6 to 10 hours after the morning rush hour. Meanwhile, the polluted air mass moves away from the center city, causing the high smog levels to occur in the suburbs hours later. Carbon monoxide thus has it greatest effect on the downtown population and oxidants are more important in the suburbs.

Spatial mapping of the data is also useful for analyzing past air pollution trends and for projecting future air quality. EPA, for example, has used such mapping to indicate changes in the area subject to given air pollution concentrations. Figure 3 shows how the area experiencing high oxident levels has changed in the south coast basin of California. Air pollution in the area experiencing the worst air pollution in the region has diminished much more rapidly than the regionwide maximum pollution concentration. In general, this relationship holds true for population exposure as well. The number of people exposed to serious air pollution will decrease more rapidly than the regionwide, peak air pollution concentration.

Table 1

Comparison of Pollutant Standards Index (PSI) Values with Pollutant Concentrations and Health Effects

Index value	Air quality level	Pollutant levels					Health effect descriptor	General health effects	Cautionary statements
		TSP (24-hour) μg/m³	SO_2 (24-hour) μg/m³	CO (8-hour) μg/m³	O_3 (1-hour) μg/m³	NO_2 (1-hour) μg/m³			
500	Significant harm	1,000	2,620	57.5	1,200	3,750		Premature death of ill and elderly. Healthy people will experience adverse symptoms that affect their normal activity.	All persons should remain indoors, keeping windows and doors closed. All persons should minimize physical exertion and avoid traffic.
400	Emergency	875	2,100	46.0	1,000	3,000	Hazardous	Premature onset of certain diseases in addition to significant aggravation of symptoms and decreased exercise tolerance in healthy persons.	Elderly and persons with existing diseases should stay indoors and avoid physical exertion. General population should avoid outdoor activity.

300	Warning	825	1,600	34.0	800	2,260	Very unhealthful	Significant aggravation of symptoms and decreased exercise tolerance in persons with heart or lung disease, with widespread symptoms in the healthy population.	Elderly and persons with existing heart or lung disease should stay indoors and reduce physical activity.
200	Alert	375	800	17.0	[2] 400	1,130	Unhealthful	Mild aggravation of symptoms in susceptible persons, with irritation symptoms in the healthy population.	Persons with existing heart or respiratory ailments should reduce physical exertion and outdoor activity.
100	NAAQS	260	365	10.0	160	(1)			
50	50 percent of NAAQS	[3] 75	[3] 80	5.0	80	(1)	Moderate		
0		0	0	0	0	(1)	Good		

[1] No index values reported at concentrations below those specified by alert level criteria.

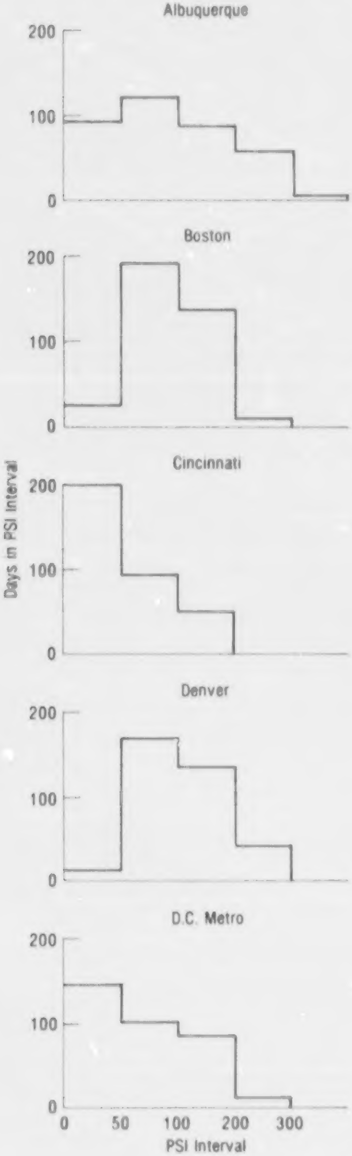
[2] 400 µg/m³ was used instead of the O_3 alert level of 200 µg/m³.

[3] Annual primary NAAQS.

Source: Environmental Protection Agency, *Guideline for Public Reporting of Daily Air Quality—Pollutant Standards Index (PSI)*, EPA-450/2—76-013, OAQPS 1.2-044 (Research Triangle Park, N.C., 1976), Table 3, p. 10.

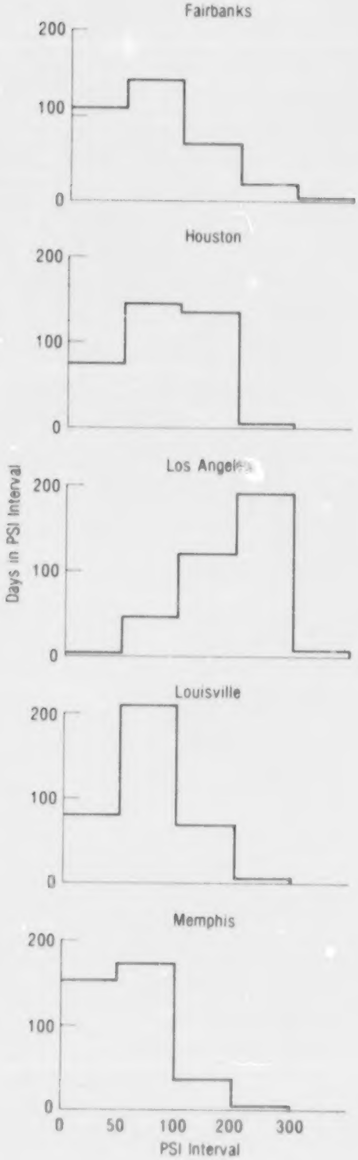
Figure 1

Pollutant Standards Index (PSI) Distributions for 20 Air Quality Control Regions (AQCR's), 1975



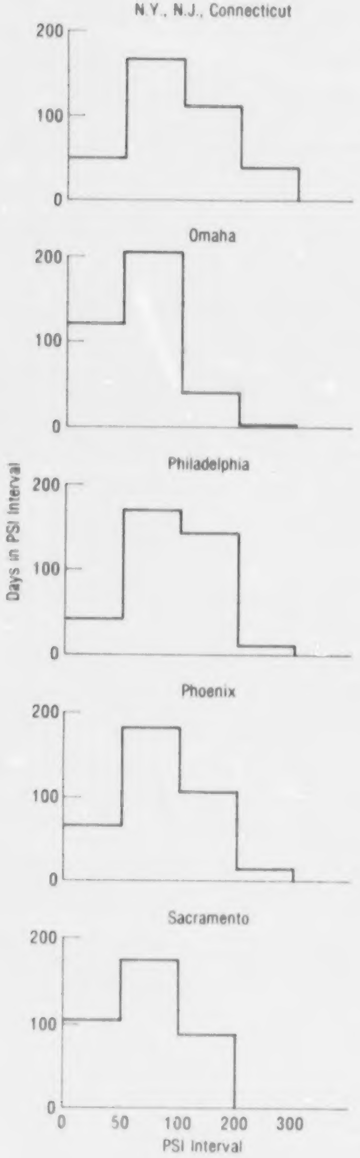
Pollutant	Days in PSI Interval 100-200	200-300	>300
CO	88	58	4
CO	97	10	
Oxidants	40		
	137	10	
Oxidants	50		
TSP	1		
	51		
CO	57	40	
Oxidants	73		
TSP	5	2	
	135	42	
CO	5	1	
Oxidants	79	5	
	84	6	

Figure 1 (continued)



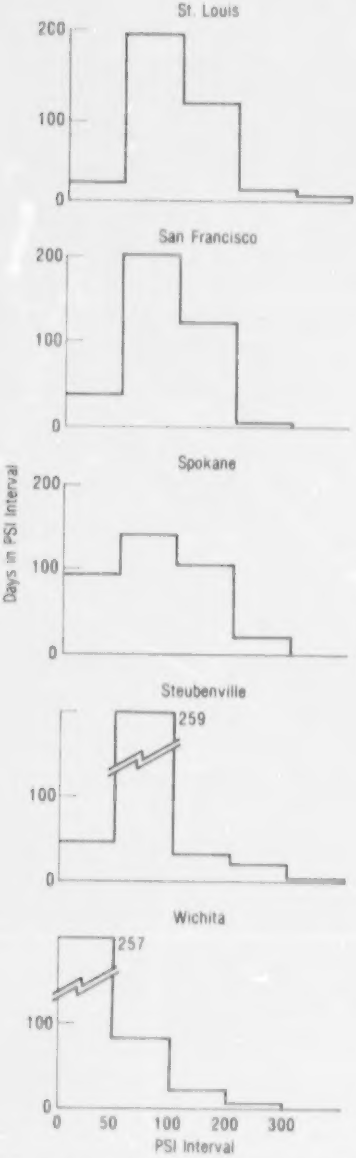
Pollutant	Days in PSI interval 100-200	200-300	>300
CO	67	20	2
TSP	1		
	68	20	2
CO	4	1	
Oxidants	131	5	
	135	6	
CO	46	78	5
Oxidants	74	112	3
	120	190	8
CO	46	4	
Oxidants	22		
	68	4	
CO	5	2	
Oxidants	31		
	36	2	

Figure 1 (continued)



Pollutant	Days in PSI Interval		
	100-200	200-300	>300
CO	71	36	
Oxidants	39	3	
	110	39	
CO	12		
Oxidants	21		
TSP	6	1	
	39	1	
CO	14		
Oxidants	126	9	
TSP	1		
	141	9	
CO	73	11	
Oxidants	27		
TSP	5	2	
	105	13	
CO	12		
Oxidants	76		
	88		

Figure I (continued)

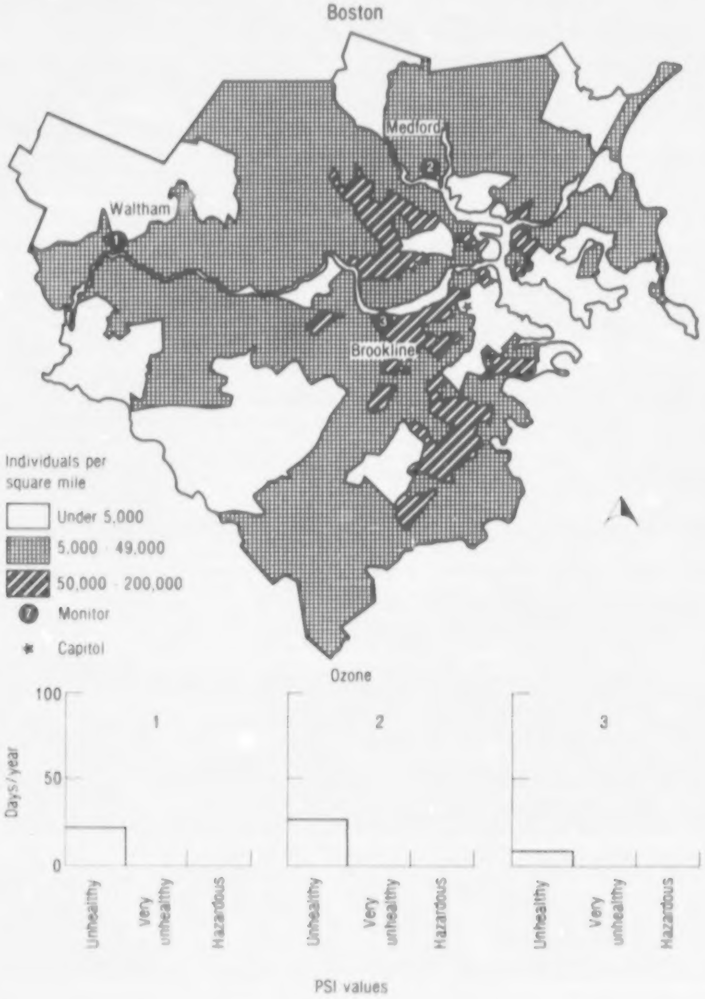


Pollutant	Days in PSI Interval 100-200	200-300	>300
CO	44	6	4
Oxidants	74	6	1
TSP	3	1	1
	121	13	6
CO	42	6	
Oxidants	79		
	121	6	
CO	105	21	
TSP	30	17	2
TSP x SO_x		11	
	30	28	2
CO	20	5	

Source: Based on EPA's SAROAD system data.

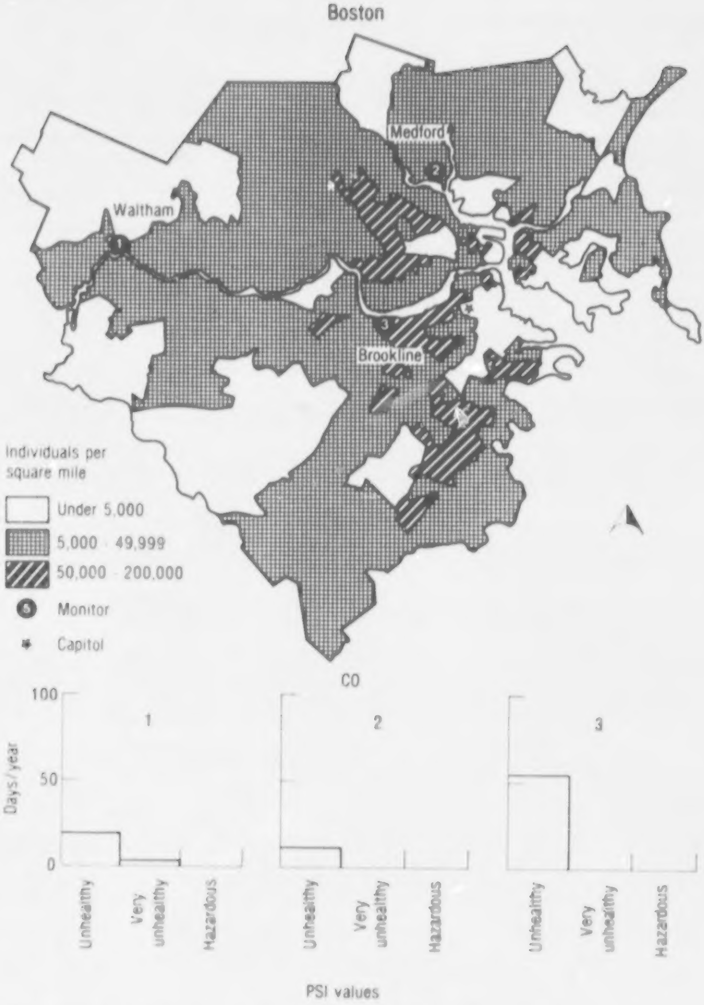
Figure 2

Ozone and CO Pollutant Standards Index (PSI) Distributions, Boston, Denver, Philadelphia, 1975


Boston
Medford
Waltham
Brookline
1
2
3
Individuals per square mile
Under 5,000
5,000 - 49,000
50,000 - 200,000
Monitor
Capitol
Ozone
100
50
0
Days/year
Unhealthy
Very unhealthy
Hazardous
PSI values

Air quality maps can help in estimating the health risks of individual pollutants to the population exposed to them. We estimated

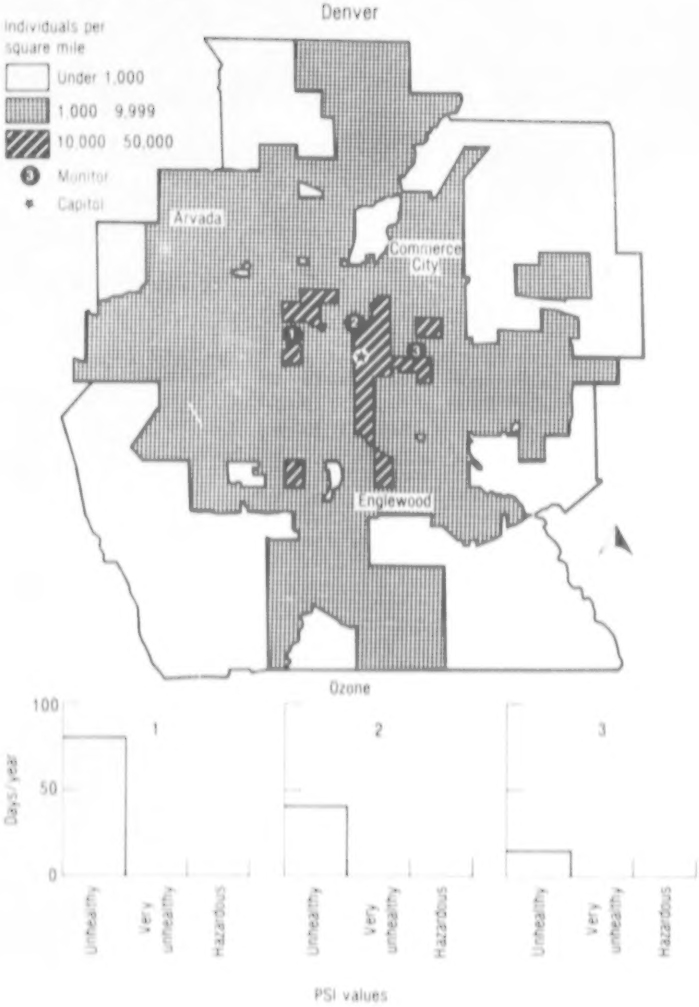
Figure 2 (continued)


Boston
Medford
Waltham
Brookline
1
2
3
individuals per square mile
Under 5,000
5,000 - 49,999
50,000 - 200,000
Monitor
Capitol
CO
Days/year
100
50
0
1
2
3
Unhealthy
Very unhealthy
Hazardous
PSI values

the population exposure to sulfur dioxide and particulate pollution in our 1974 Annual Report. EPA has made similar estimates. Figure 4 shows trends in exposure to TSP.

Additional information is needed to develop health risk models. First, it is necessary to identify the groups that are susceptible to the effects of each air pollutant. For some pollutants, at levels currently being observed, the people most affected are individuals with pre-

Figure 2 (continued)


Denver
Individuals per square mile
Under 1,000
1,000 - 9,999
10,000 - 50,000
3 Monitor
Capitol
Arvada
Commerce City
Englewood
1
2
3
Ozone
100
50
0
Days/year
1
2
3
Unhealthy
Very unhealthy
Hazardous
PSI values

disposing diseases such as asthma, emphysema, and heart disease. For others, children and athletes are the populations of concern. Some pollutants can affect the entire population—causing eye irritation, cough, and headache.

Second, we need to estimate the relationship between exposure to the pollutant and its expected effect on each segment of the susceptible population. These estimates are generally based on studies of exposed populations or, sometimes, on controlled laboratory studies on human subjects. This basis for estimation probably leads to under-

Figure 2 (continued)

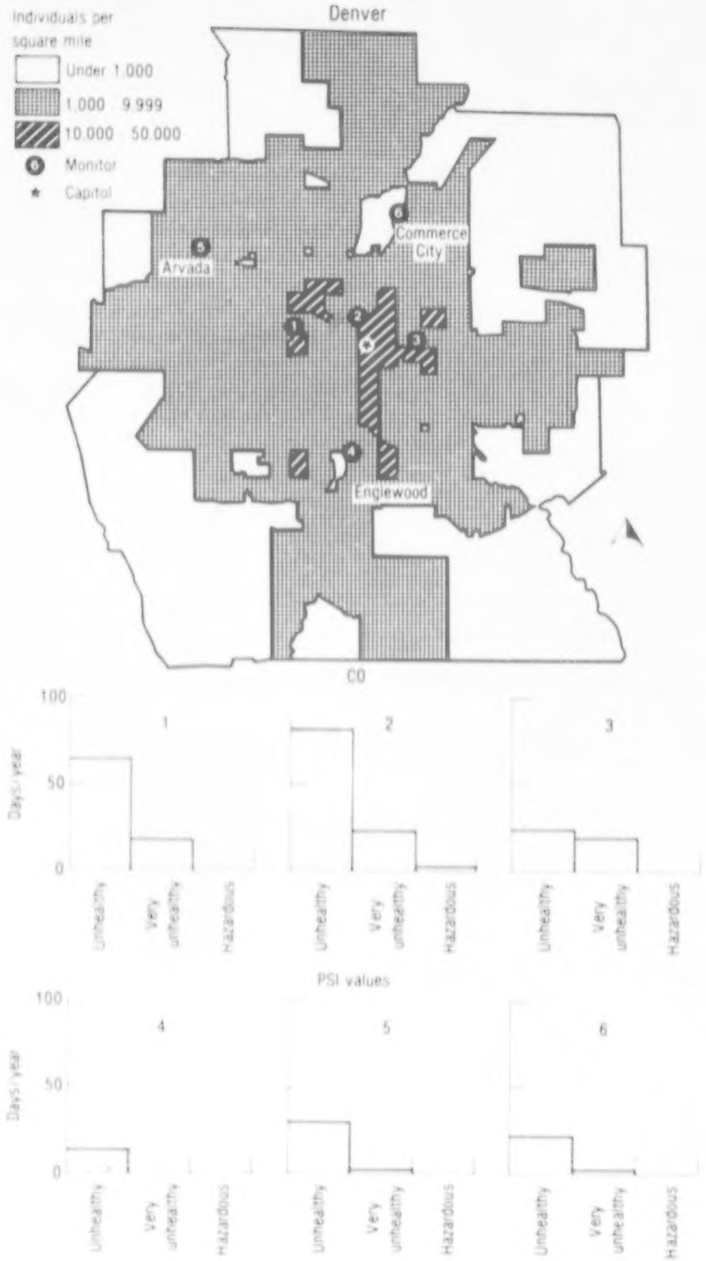
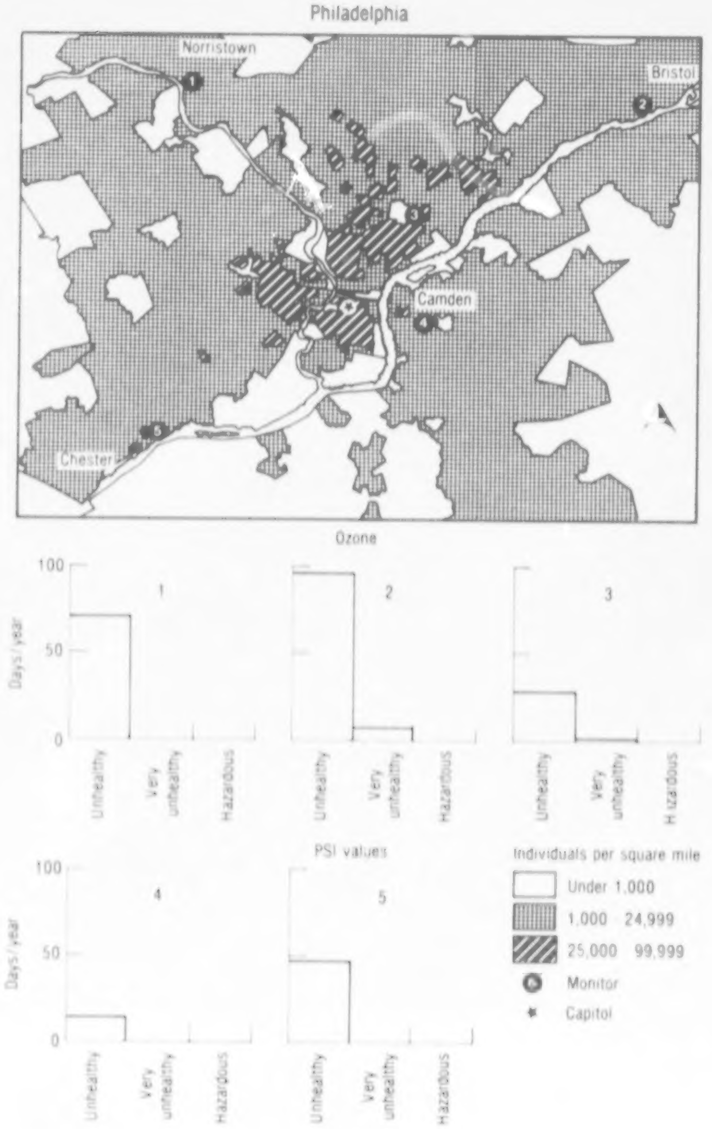
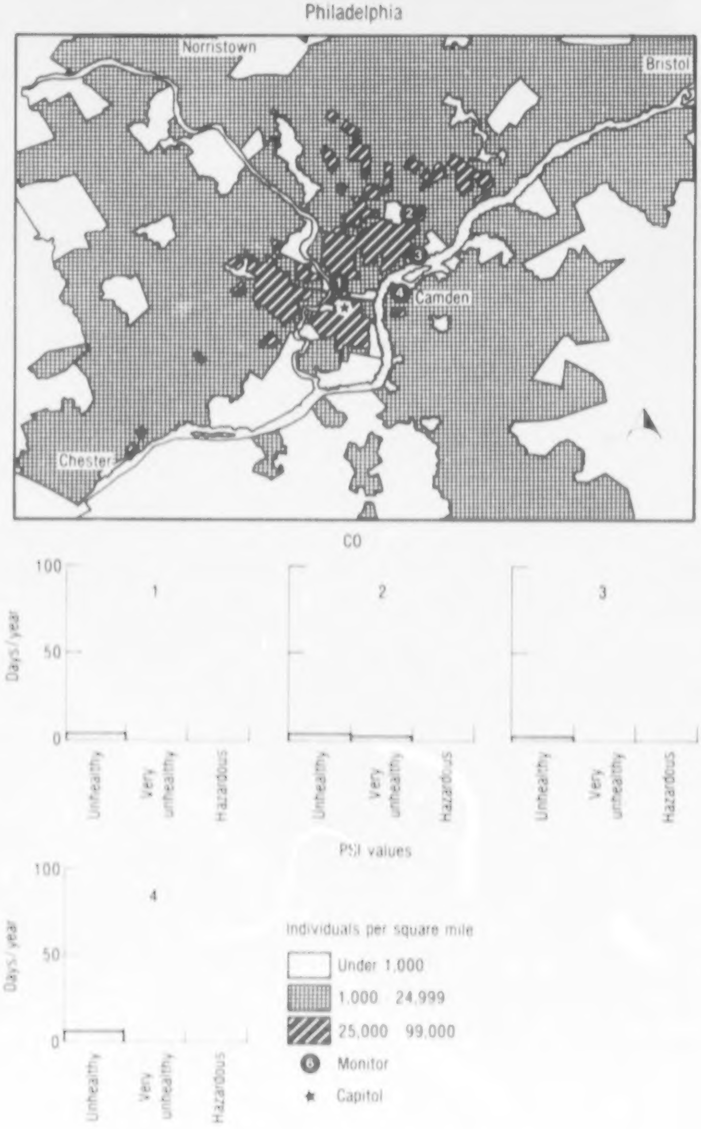

Individuals per square mile
Under 1,000
1,000 - 9,999
10,000 - 50,000
Monitor
Capitol
Denver
Arvada
Commerce City
Englewood
1
2
3
4
5
6
CO
100
50
0
Days/year
Unhealthy
Very unhealthy
Hazardous
PSI values

Figure 2 (continued)


Philadelphia
Norristown
Bristol
Camden
Chester
1
2
3
4
5
Ozone
Days/year
100
50
0
Unhealthy
Very unhealthy
Hazardous
PSI values
Individuals per square mile
Under 1,000
1,000 24,999
25,000 99,999
Monitor
Capitol

estimation of the total impact of a pollutant because it does not account for the more subtle or longer-term effects. Physiological response to levels of pollution encountered in the ambient air are often observed in test animals, but it is difficult to translate this

Figure 2 (continued)

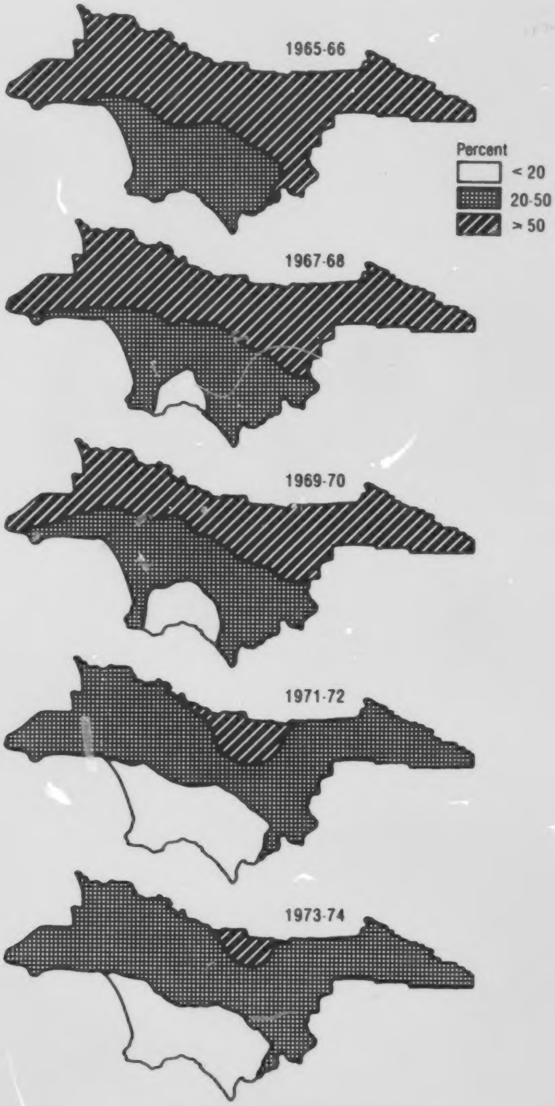

Philadelphia
Norristown
Bristol
Camden
Chester
1
2
3
4
CO
100
50
0
Days/year
1
2
3
4
Unhealthy
Very unhealthy
Hazardous
PSI values
Individuals per square mile
Under 1,000
1,000 24,999
25,000 99,000
Monitor
Capitol

information into expected human effects. Confirmation of the effects on animals requires field or laboratory studies of human effects.

Third, the mobility of populations at risk must be considered. To determine the cumulative effect of a given level of pollution on an

Figure 3

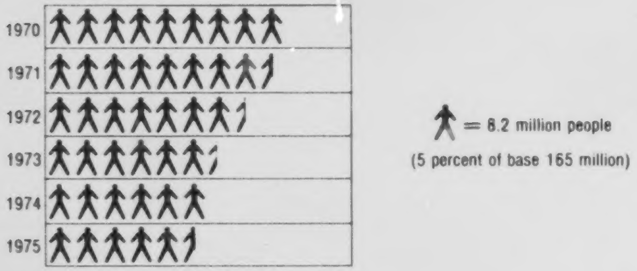
Days on Which Oxidants Exceeded the National Primary Ambient Air Quality Standard (NAAQS), Los Angeles, 1965–74


1965-66
Percent
< 20
20-50
> 50
1967-68
1969-70
1971-72
1973-74

Source: U.S. Environmental Protection Agency, *Trends in the Quality of the Nation's Air,* (Washington, D.C.: Government Printing Office, 1977), p. 13.

Figure 4

Trends in National Population Exposure to Particulate Matter Levels above the National Primary Ambient Air Quality Standard (NAAQS), 1970–75



Source: U.S. Environmental Protection Agency, *Trends in the Quality of the Nation's Air* (Washington, D.C.: Government Printing Office, 1977), p. 5.

individual, we need to know where the individual is when air pollution levels exceed ambient standards. For example, in estimating CO effects, we should know where the susceptible people are during the 4 to 8 hours of high CO levels. Because CO levels are generally highest in the central city during the day, the working population is the most exposed.

Further, whether the exposed population is outdoors or indoors is important in estimating health risks. Buildings act as partial barriers to outdoor pollution. Most people spend the majority of their time indoors, so that the measured levels of outdoor pollution generally overpredict actual exposure. Because downtown buildings are usually air conditioned and use outside air only as makeup air, they tend to dilute most pollutants.* The same is true to a lesser degree of suburban homes. Under certain conditions pollutants generated indoors exceed the ambient standards.[3] On the other hand, people who work in open shops along street canyons, taxi drivers, and policemen may be exposed to carbon monoxide at levels near those indicated by monitoring site data.

It is evident that the effects of these factors cannot be gauged precisely. To take the uncertainties into account, we can estimate best and worst cases for each factor. Place of work data are obtainable from local transportation planning surveys. Demographic maps are a starting point for determining residential population densities. Susceptible populations and health effect-exposure relationships must be based on published reports.[4] The indoor-outdoor relationship is probably the most uncertain.

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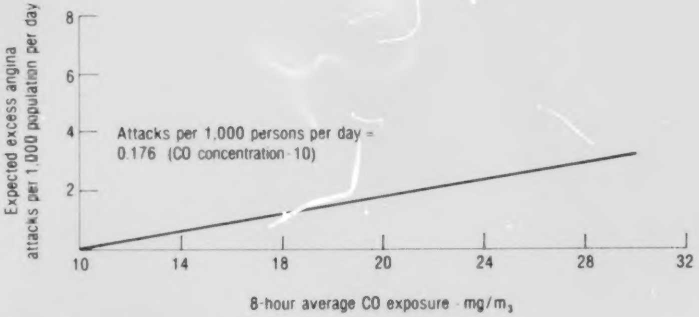
*Although pollutants are generated indoors, indoor pollution has not been well studied. The present analysis is confined to estimating the risks of outdoor (ambient) air pollution.

The Council is developing health risk models for two pollutants—carbon monoxide and oxidants—using the factors described above to guide the estimates. The health effects of carbon monoxide are fairly well understood at the levels observed in urban areas, and it appears that patients with angina pectoris, a form of heart disease, are the major population at risk in these areas. There are approximately 4.2 million angina patients in the United States. They suffer attacks of chest pain, often several times a day, because the heart muscle lacks oxygen.

In order to estimate the number of angina attacks suffered by angina patients because of CO exposure, we applied the CO risk model being developed by CEQ and EPA, to two cities, Los Angeles and Denver. In Los Angeles the excess number of attacks annually is probably between 530,000 and 690,000. In Denver the estimated range was 31,000 to 75,000. These figures exclude any adjustment for possible indoor-outdoor differences. The estimated number of attacks from all causes is between 50 and 160 million per year in Los Angeles and between 10 and 30 million in Denver. Figure 5 shows the relationship between 8-hour carbon monoxide exposure and the number of additional attacks expected per 1,000 persons. In addition to the higher number of angina pectoris attacks, one would also expect an associated increase in rate of fatal heart attacks among the susceptible population. It would seem that the more angina pectoris attacks a patient has, the greater is the risk of a heart attack.

Figure 5

CO Levels and Expected Angina Attacks



Source: J. Knelson and K.H. Jones, report in preparation.

The Council's oxidant risk analysis is not complete, but it appears that the risk will be greater for ozone than for carbon monoxide. The reasons are several: The areas experiencing ozone violations are much larger and their populations much larger than the places where the CO standard is being exceeded. There are more known health effects for ozone and therefore the population at risk is larger. For example, ozone affects individuals with preexisting heart and lung ailments and causes healthy people to suffer excess headaches, cough, and eye irritation. Thus the effects of ozone are broader in many ways than those of CO. However, although CO affects fewer people than ozone, the impact of high CO concentrations on angina pectoris patients may be severe.

TRENDS IN URBAN AIR QUALITY

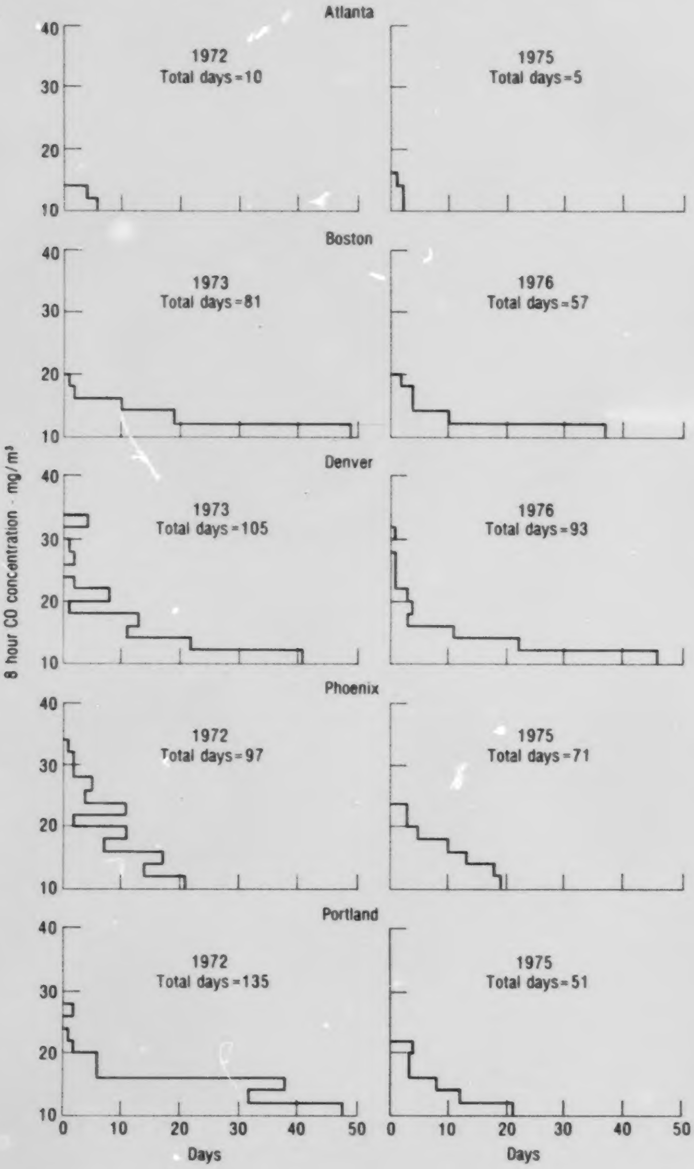
Strong control programs for particulates and sulfur dioxide, in effect in the last few years, have reduced emissions to the point that very few urban regions are now experiencing violations of the standards for these pollutants. Ambient CO and ozone levels have fallen at a slower rate because for the most part the major focus has been on emissions from new motor vehicles. Essentially, emissions decrease at the same rate as new cars and trucks replace the old. Monitoring data taken over the past 5 years show a parallel drop in CO and ozone levels and emissions.

Projections of air quality are often very controversial. Basing our estimates on current air quality data and expected control and on the assumption that an aggressive program will be initiated where necessary, the Council projects that the CO and oxidant air quality standards can be met by 1990 in all but a few urban regions. If available control technology were put to use, even a rapid increase in coal consumption should not reverse present trends and cause greater local impacts from the criteria pollutants SO_2, NO_2, and particulates. However, other pollutants associated with coal combustion and coal conversion processes may raise new problems. The health effects of sulfates and nitrates, which result from atmospheric conversion of SO_x and NO_x emissions, have yet to be quantified. Trace metals and organic carcinogenic compounds may also be emitted in sufficient quantities to be of concern. These problems are most likely to arise in regions where a heavy concentration of coal use is anticipated—such as the Ohio Valley. Further, the sulfur dioxide that escapes available emission control systems could add to existing sulfate problems.

Air quality trends shown here reflect the frequency of violations measured over the past several years at individual monitoring sites or at several sites simultaneously. Carbon monoxide trends for eight cities are shown in Figure 6. In general, the picture is one of improvement, although the improvements vary considerably from one city to the next partly because of different emissions reductions but also because of such factors as year-to-year variations in weather and changes in traffic patterns. Where the data for the eight cities are combined, the influence of such adventitious factors is reduced. The difference in area under the two curves represents the general improvement. For the entire nation except California, 78 percent of

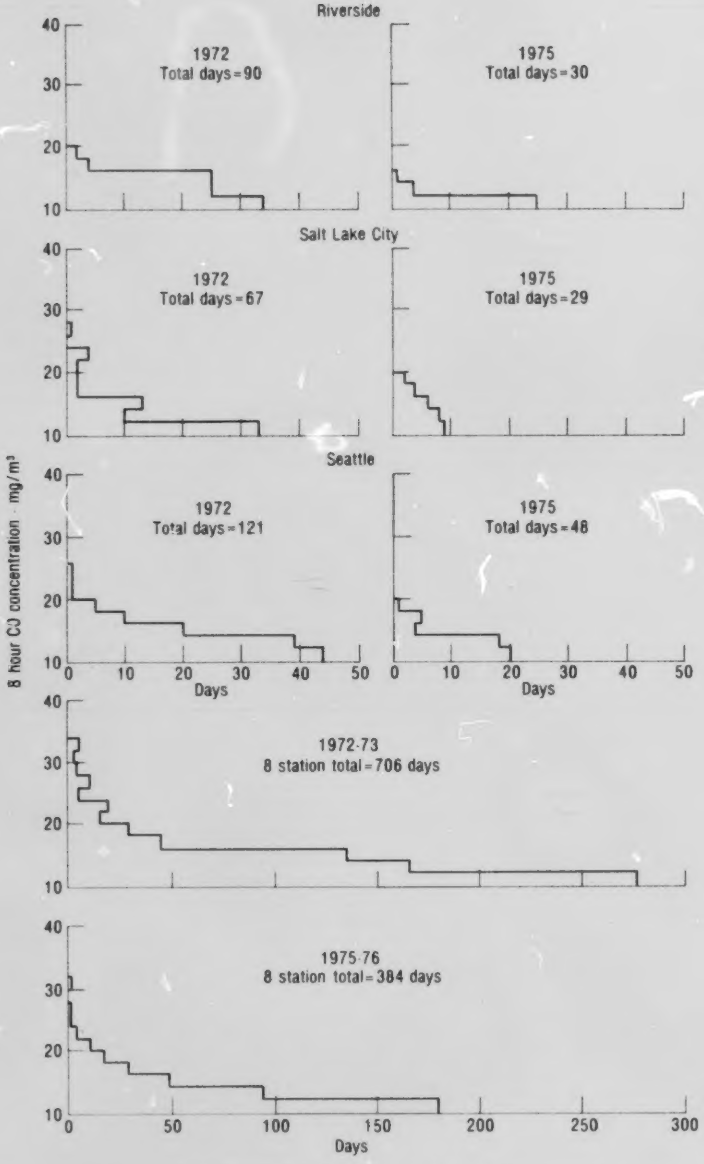
Figure 6

CO Trends in Eight Cities, 1972–73 to 1975–76



Reduction = 46 percent from 1972-73 to 1975-76

Figure 6 (continued)



Reduction = 46 percent from 1972-73 to 1975-76

Source: UPGRADE, based on EPA's SAROAD system data.

the CO monitoring stations with 3 or more years of data have shown improvement. In California, where there are more historical data, 81 percent of the stations showed declining levels from 1970 to 1975.

Trends for ozone (or oxidants) also show improvement, as Figure 7 indicates for seven cities. Two, Denver and Toledo, have increased violation frequencies; here growth has apparently overriden gains in emissions control. Despite these increases, the overall trend for the seven cities shows a 22 percent average improvement.

For urban regions where emissions data are available, the relationship between air quality and emissions trends can be demonstrated. Figure 8 shows oxidant levels for the past 10 years in the San Francisco Bay area. Each diagram represents the combined data from 10 monitoring sites covering all geographical areas of the region. Figure 9 shows air quality and hydrocarbon emission trends. (Hydrocarbons and nitrogen oxides are the two precursors of ozone formation in the atmosphere.) Improved air quality levels generally parallel reduced emissions, but the number of violations of the oxidant standard declined much more rapidly than the air quality levels.

Determination of the mathematical relationship between pollutant emissions and resulting air quality levels is a necessary element for projecting air quality. The accuracy of such relationships (or models) may be evaluated against real data. Here the San Francisco data are useful. The most common model used for projecting air quality is simple proportional rollback—that is, a reduction in pollutant emissions brings about a corresponding reduction in the levels of that pollutant in the atmosphere. From 1967 to 1976, hydrocarbon emissions in the San Francisco area were reduced 25 percent, and daily observed oxidant levels also declined 25 percent. The agreement between predicted and observed violations of the oxidant standard, shown in Figure 10, was excellent. The recent improving trend in oxidant air quality in Los Angeles is also consistent with simple proportional rollback.[5]

Many other assumptions, some uncertain, contribute to the making of air quality projections. Among them are assumptions about the efficacy of emissions controls, population growth, numbers of cars and trucks on the road, and other such factors, all largely independent of each other. The many combinations possible from varying these assumptions produce a range of projections. The projections presented here are in midrange, being neither the most optimistic nor the most pessimistic.

Ozone [6]

Projections of ozone levels are based on assumptions about both future pollutant emissions and the atmospheric chemistry of ozone production from nitrogen oxides and hydrocarbons. Projections of emissions in turn are an aggregation of assumptions about emission

Figure 7

Ozone Trends in Seven Cities, 1973–74 to 1975–76[1]

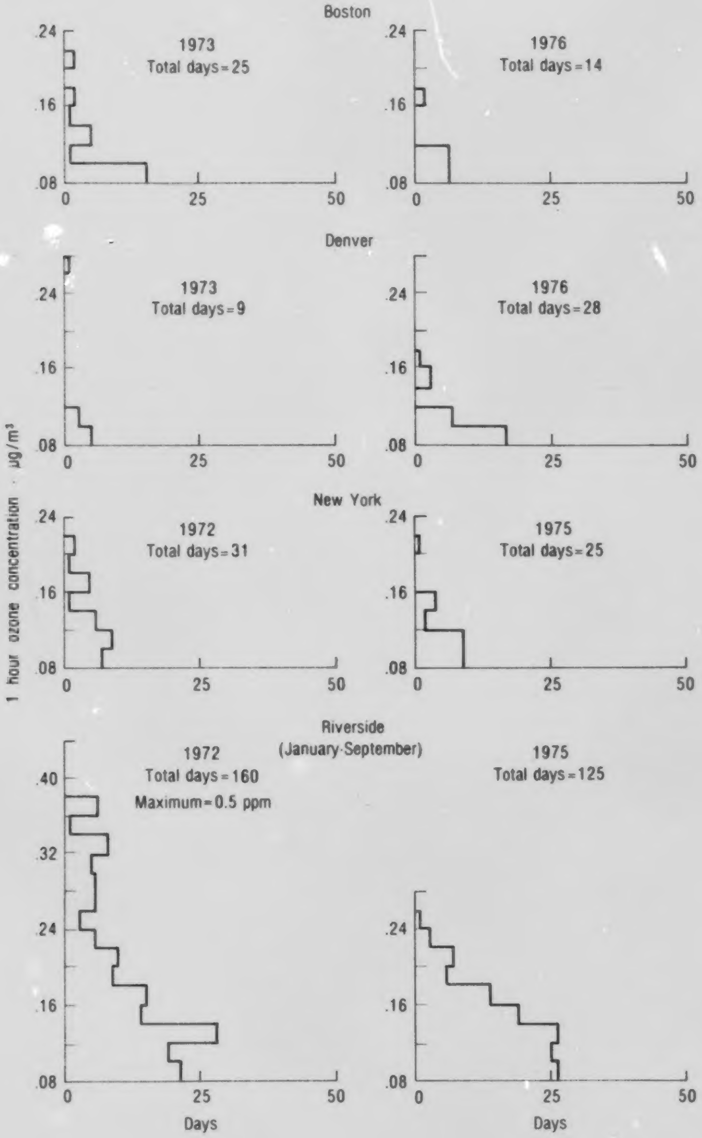
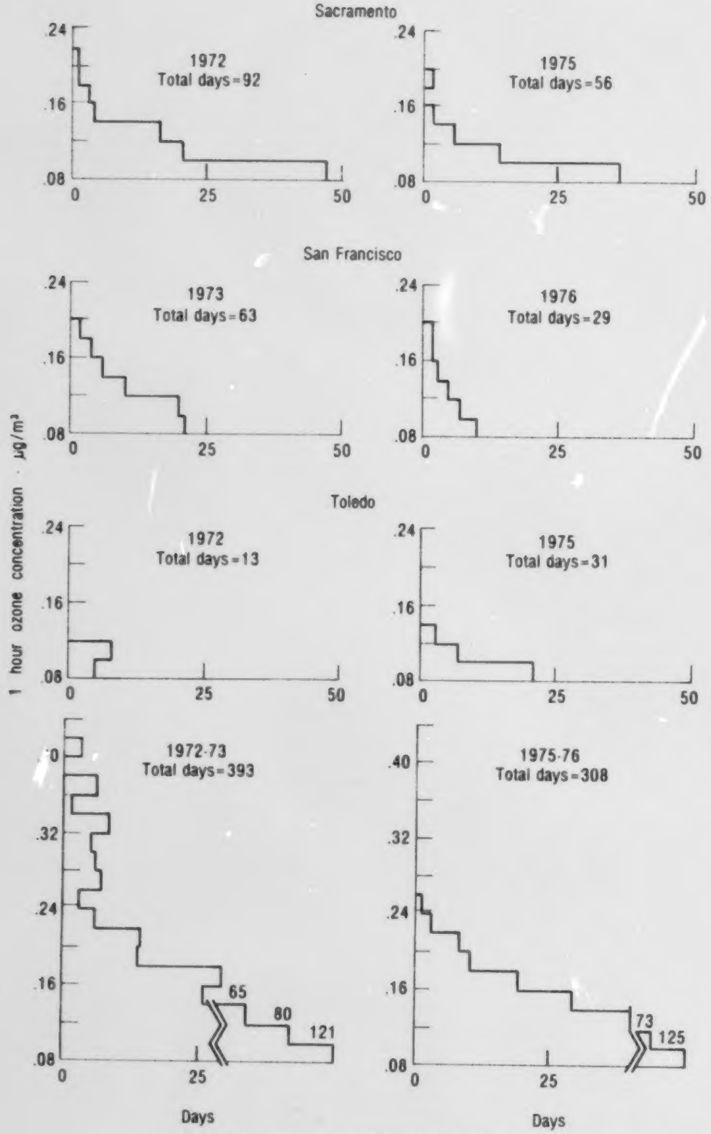


Figure 7 (continued)

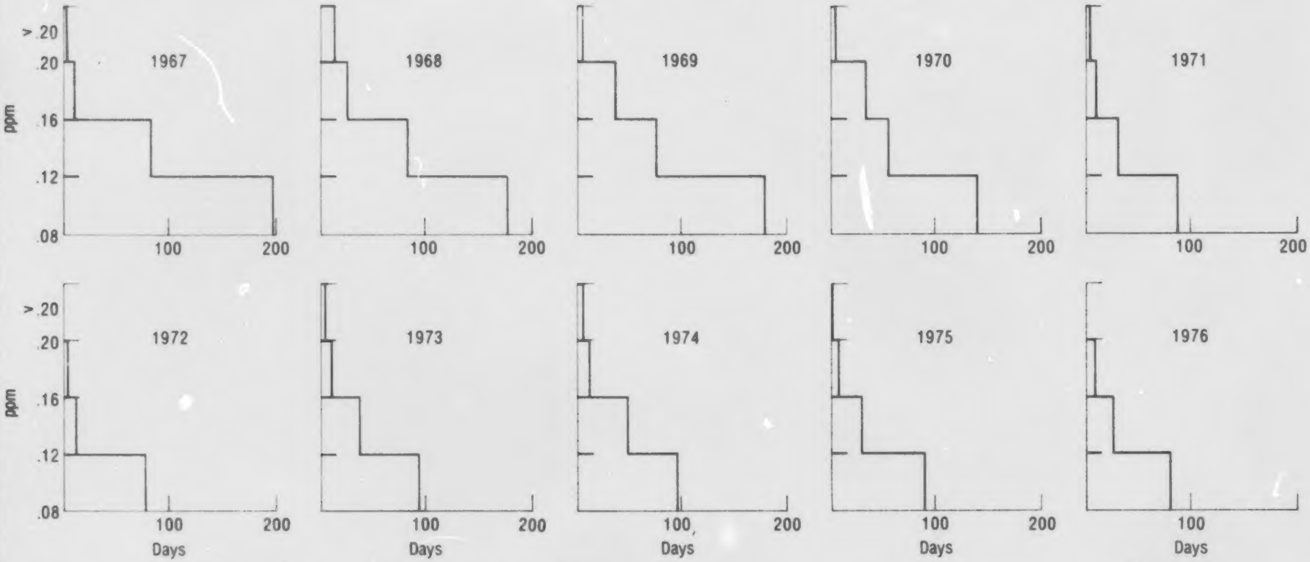


Reduction = 22% from 1972-73 to 1975-76

[1] Single station data, may not be worst case for each city.
Source: UPGRADE, based on EPA's SAROAD system data.

Figure 8

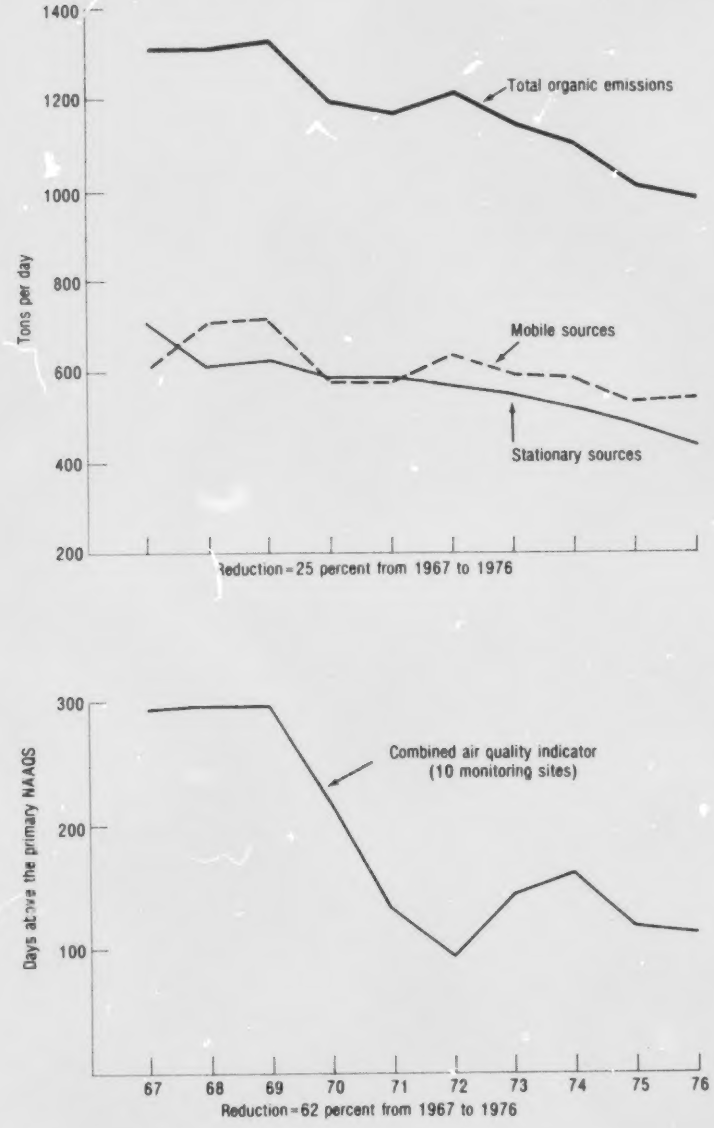
Ozone Trends, San Francisco Bay Area, 10 Sites, 1967–76



Source: Based on San Francisco Bay Area Air Pollution Control District data.

Figure 9

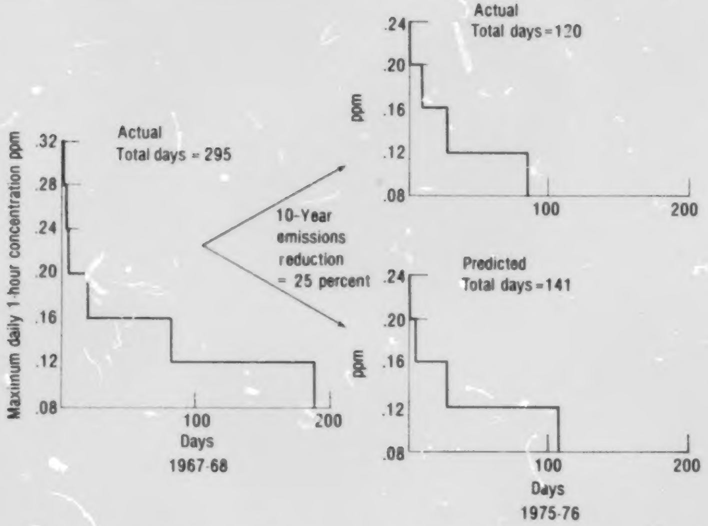
Trends in Organic Emissions and Air Quality, San Francisco Bay Area, 1967–76



Source: Based on San Francisco Bay Area Air Pollution Control District data.

Figure 10

Actual and Projected Ozone Levels, San Francisco Bay Area, 1967–76



Source: Based on San Francisco Bay Area Air Pollution Control District data.

rates from various sources, the rate at which these sources grow in size and number, and the extent to which emissions are controlled.

The major sources of unburned hydrocarbons in most cities are associated with the operation of motor vehicles, including emissions from automobiles, trucks and buses. A significant amount is caused by evaporation of gasoline and diesel fuel throughout the storage, transport, and refueling process.

Today the average car emits approximately 7.4 grams of hydrocarbons per mile.[7] EPA projects that with current emission standards and institution of inspection and maintenance programs, cars will emit no more than 1.8 grams in 1990,[8] including an adjustment for 2 percent growth. CEQ assumed that the total hydrocarbon emissions contribution by light duty and heavy duty trucks and buses would be effectively reduced by 50 percent by 1990, including 2 percent growth.

Nonvehicle-related hydrocarbons come from such diverse sources as dry cleaning establishments, evaporation of solvents in the application of paints and other coatings, industries which use petroleum-based solvents, refineries, and chemical manufacturing plants. Information about the relative contributions and reactivity of different hydrocarbons is uncertain. Nevertheless, an aggressive abatement effort can reduce the amount that individual facilities emit by up to

90 percent. The CEQ projections assume that the abatement efforts will be sufficiently vigorous in those areas suffering the most serious oxidant problems that emissions from such stationary sources both old and new will have been reduced by an average of 55 percent by 1990, including growth.

For motor vehicles equipped with catalysts, most tailpipe emissions will occur when the vehicle is started—before the catalyst has time to heat up. Thus the relevant growth factor is the increase in the number of "cold starts." For trucks, buses, and automobiles which were manufactured before 1975 without catalysts, the number of vehicle miles traveled is a more relevant growth factor. Both factors probably vary from city to city, but the Council's projections used an average growth rate of 2 percent for all areas.

The stationary source growth rate will also differ from city to city and from source to source. Most urban areas in the North and East are growing slowly, if at all, while others, such as Houston and Denver, continue to grow rapidly. Some sources can be assumed to grow in proportion to population; examples are dry cleaning and fuel marketing. Industrial sources, however, usually grow at a more rapid rate, and the index of industrial production provides a better growth index if specific industry growth rates are not available. CEQ assumed an average growth rate of 3 percent for all stationary source emissions.

The production of oxidants from unburned hydrocarbons in the atmosphere is a complicated chemical reaction involving nitrogen oxides and sunlight. EPA is continuing its attempt to develop better mathematical models for use in its projections.

We have used the simple proportional rollback model, which assumes that a reduction in hydrocarbon emissions brings about a corresponding reduction in ozone levels. We have also considered other factors in our projections, such as changes in location of emission sources, changes in reactivity of the hydrocarbon emissions, and existence of "background" pollutants (i.e., pollutants that are carried into an area from outside and whose original source may be man-made or natural).

The importance of the location of the emissions lies in the fact that the concentration of oxidants is related to the concentration—not the mass—of hydrocarbons emitted. Because our urban areas are growing outward and new industries are being located in the suburbs rather than in the central city with the older industries, emissions in 1990 will probably be spread over a larger area than they are now. This factor is particularly significant with respect to automobile emissions, which presently occur throughout the driving cycle. A high proportion is now emitted in the central city, but in 1990 most emissions will occur at lower concentrations in the suburbs where the automobiles are started. Council projections attempt to take this factor into account.

Reactivity is not explicitly considered in most of the atmospheric chemistry models currently being developed. Yet the rate at which hydrocarbon molecules react to form ozone depends very much on the hydrocarbon. Hydrocarbons emitted with a catalytic converter, for example, have a lower average reactivity than those emitted without a catalyst. Our projections take this fact into account.

The role of "background" oxidant levels is not well understood. Oxidant concentrations of 0.04 parts per million (one-half the ambient standard) or greater have been measured in areas remote from cities. However, these oxidants may be carried from a distant urban area. The CEQ projections assume that approximately 8 percent of current daily oxidants come from outside the urban area and will not be eliminated by abatement strategies either in that area or in the upwind region.

The Council selected 12 of the regions which are currently experiencing the highest levels of oxidant pollution in the nation. We project that only eight of these regions will fail to meet the primary air quality standard for oxidants by 1990 (see Figure 11). The south coast basin of California still remains the major problem. Houston and Philadelphia will experience approximately 10 days above the standard and the remaining five regions will experience a marginal number of excesses. Although its special geography, climate, and

Figure 11

Ozone Projections, 12 Regions, 13 Sites, 1975–90

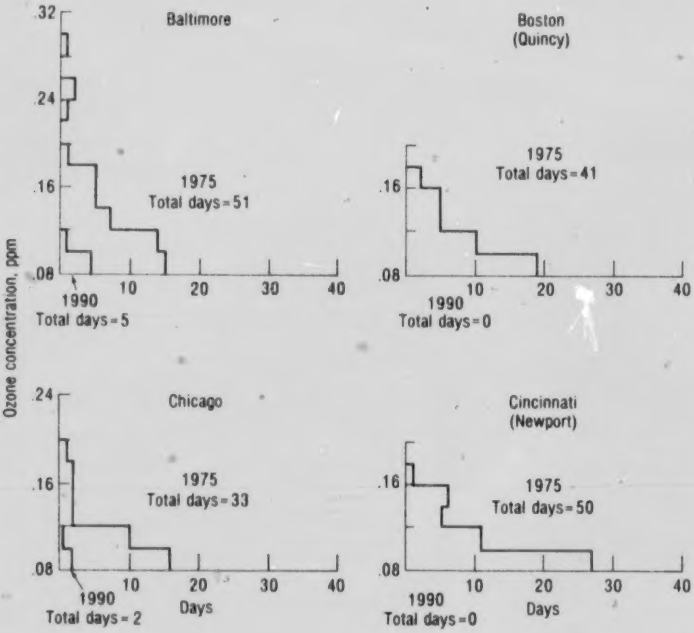
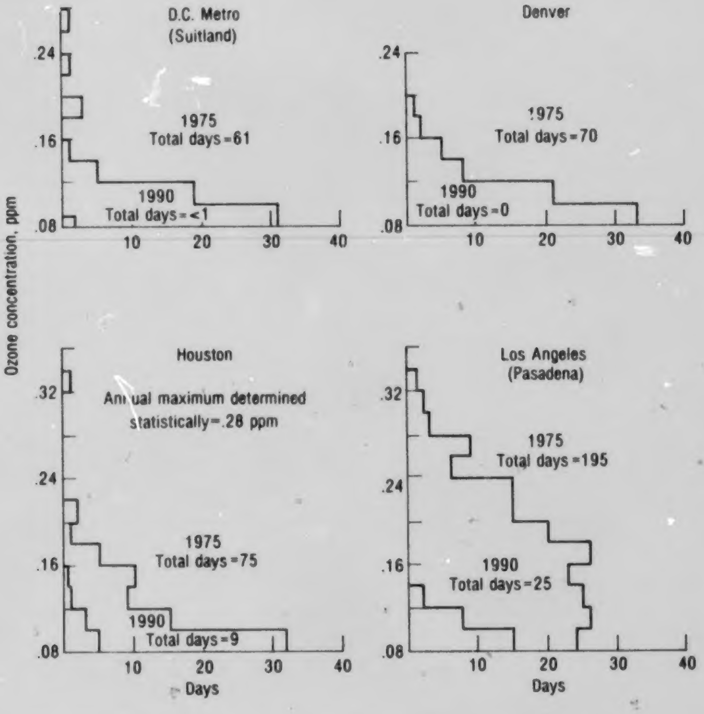
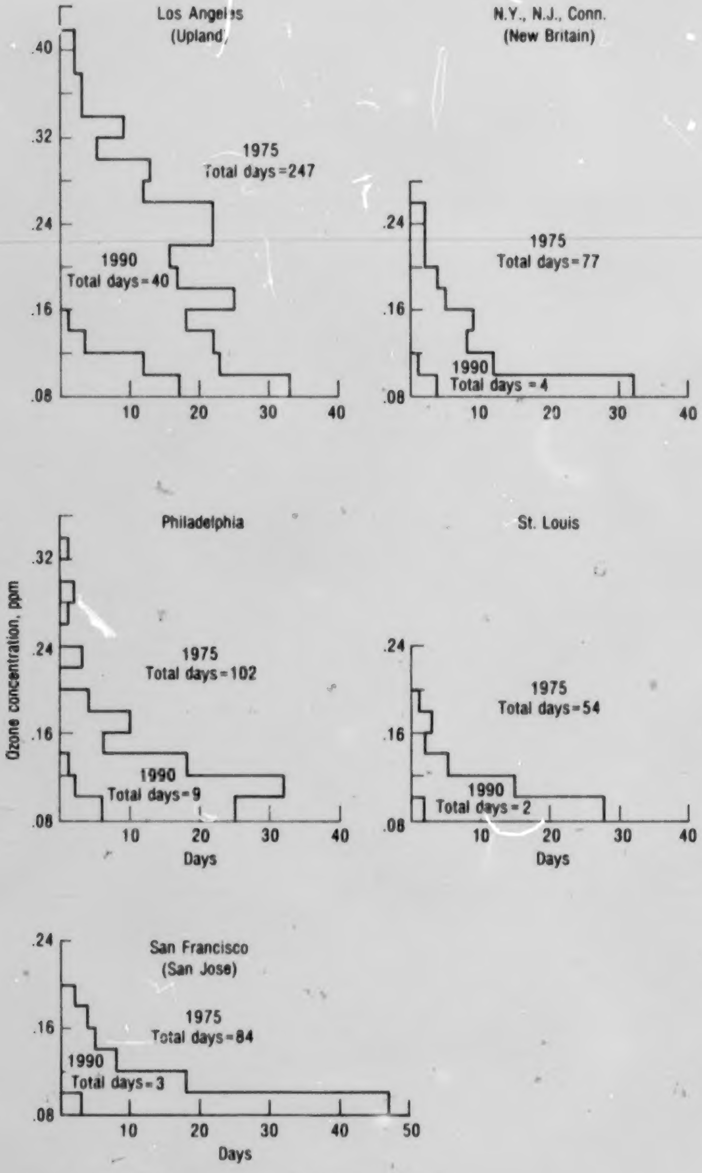


Figure 11 (continued)



dependence on cars may prevent Los Angeles from achieving the oxidant standard, dramatic improvement is projected. The number of days exceeding the standard should be reduced from 247 to 40 day in Upland, the worst area in the basin, and from 195 to 25 days in Pasadena, which ranks among the worst areas in the basin. In the Houston area the oil and petrochemicals industries are rapidly expanding, and the overall effectiveness of a control program for them is uncertain. In most regions, 50 to 75 percent of hydrocarbon emissions are from motor vehicles, but in the Houston region industry is responsible for about 65 percent of the hydrocarbon emissions. If Houston is to achieve the ambient ozone standard, control of all stationary sources will have to be rigorous. Philadelphia's problem is one of both stationary and mobile sources. Upwind contributions of hydrocarbon emissions may also be significant. Although Houston and Philadelphia are projected to fall short of meeting the standard, the improvement is equally as dramatic as the Los Angeles case. The number of excesses of the standard drops from 75 to 9 in Houston and 102 to 9 in Philadelphia.

Figure 11 (continued)



Source: UPGRADE, based on EPA's SAROAD system data.

The oxidant standard can be attained in the other four regions analyzed as well as all other cities if reasonable controls are applied to existing stationary sources and best available technology is required for new sources.

Table 2 shows the percentage improvement expected in the eight cities which are expected to exceed the air quality standard in 1990. The minimum improvement, 84 percent, will occur in the south coast basin, and the others should improve by almost 90 percent or better. We can also predict that the rate of air quality improvement is greater than the rate of emission reduction. Figure 12 shows the expected relationship for Philadelphia—if hydrocarbon emissions are reduced at a constant rate from now until 1990, it can be seen that the number of days of adverse air quality will drop from 102 in 1975 to approximately 55 in 1980 and 30 in 1985. Obviously, the hydrocarbon reduction rate will not in fact track a straight line but will follow a path which deviates somewhat. However, the rapid near-term improvements should occur.

Carbon Monoxide

It will be easier to meet the carbon monoxide air quality standard than the oxidant standard, principally because the CO problem is very

Figure 12

Ozone Projections, Emission Reductions, and Days above the National Primary Ambient Air Quality Standard (NAAQS), Philadelphia, 1975–90

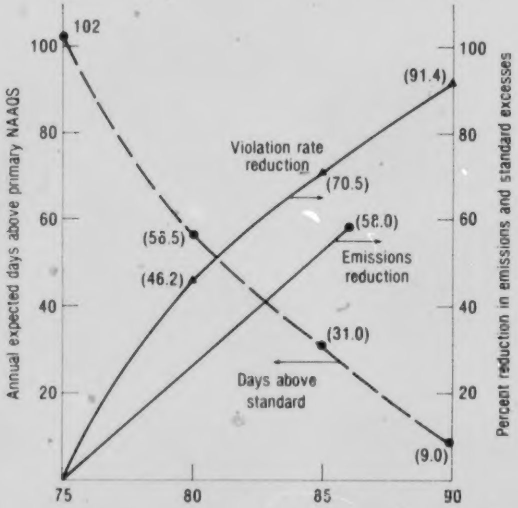


Table 2

Hydrocarbon Emissions Reduction and Expected Improvements in Air Quality, 1975–90

Region	Percent HC reduction	Days above 0.08 ppm standard		Percent change in days
		1975	1990	
Baltimore	59	51	5	90
Boston	61	41	0	100
Chicago	48	33	2	94
Cincinnati	58	50	0	100
Denver	65	70	0	100
D.C. Metro	64	61	<1	99
Houston	48	75	9	88
N.Y., N.J., Conn.	61	77	4	95
Philadelphia	58	102	9	91
St. Louis	53	54	2	97
San Francisco	53	84	3	96
South coast basin				
Upland	59	247	40	84
Pasadena	59	195	25	87

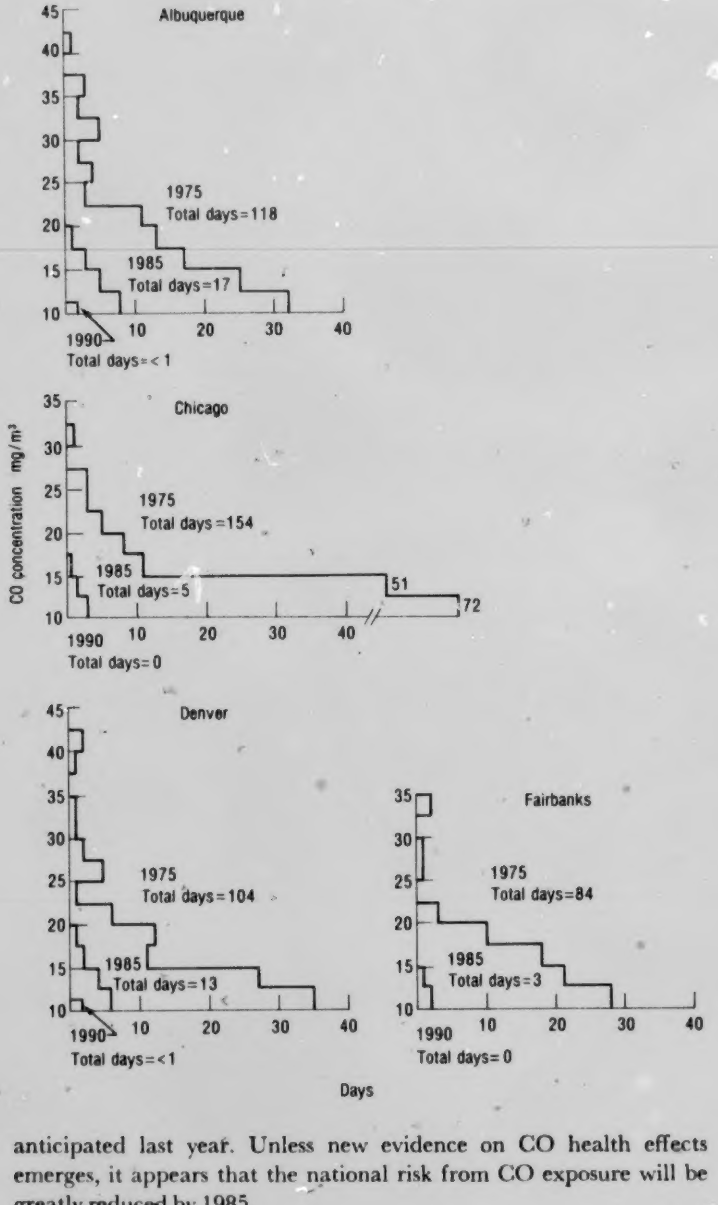
localized and automobiles are the predominant source. The same degree of emissions control for automobiles yields greater benefits for CO than for ozone. In most cities an 80 percent overall reduction in auto emissions will produce a 70–75 percent reduction in carbon monoxide levels but only a 50–60 percent reduction in ozone levels assuming that other sources of emissions remain constant.

The assumptions used for carbon monoxide projections are not quite so complex as for oxidant projections. Growth rates are limited by the amount of congestion which can occur in downtown areas. A 1 percent growth was used. Because of uncertainties about deterioration of future control systems, a conservative emissions factor of 15 grams per mile was chosen as representative of the average 1990 on-the-road car. This factor is well above the 3.4 grams per mile standard which will go into effect in 1982. Assumptions related to the relative contribution and potential control of other mobile sources were the same as for hydrocarbon control.

Figure 13 shows the carbon monoxide projections to 1990 for 7 of the 16 cities representing the nation's worst current carbon monoxide problems. All other urban regions are expected to attain the standard by 1985. The 16 cities with the worst problems should achieve the standard by 1990, with only a few violations remaining in 1985. Last year's Annual Report emphasized the severity of the CO problem in New York City. We have since learned that the monitoring data were in error because of instrument problems which overstated CO levels in the atmosphere by about 25 percent. The faulty instruments have now been corrected. Although New York's CO problem is still severe, projections based on corrected data show greater improvement than

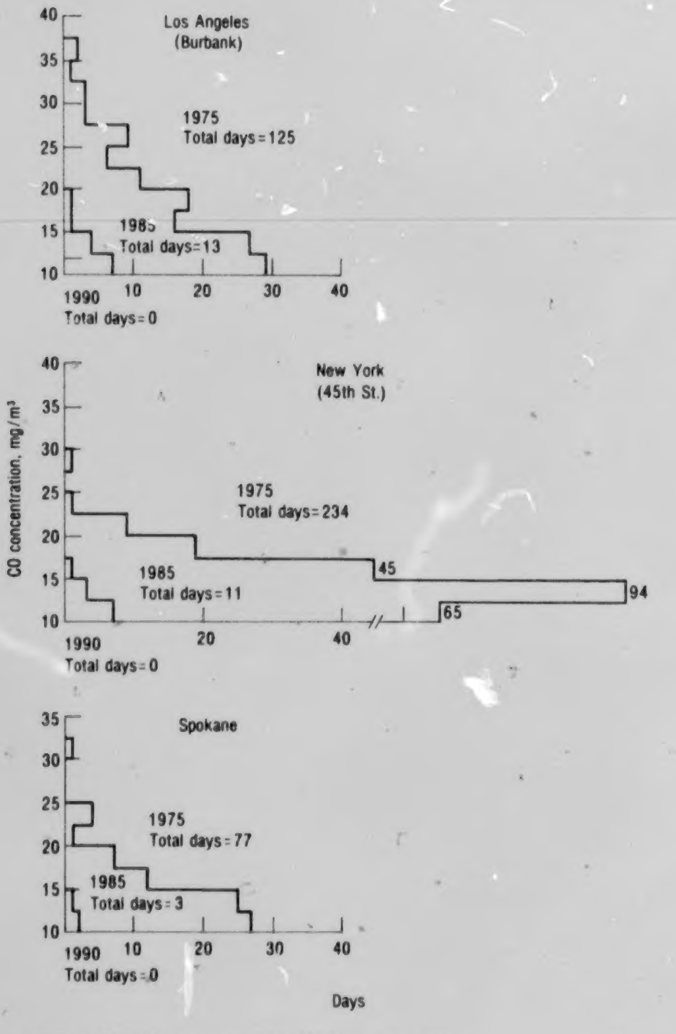
Figure 13

CO Projections, Seven Cities, 1975–90



anticipated last year. Unless new evidence on CO health effects emerges, it appears that the national risk from CO exposure will be greatly reduced by 1985.

Figure 13 (continued)



Source: UPGRADE, based on EPA's SAROAD system data.

Nitrogen Dioxide

The health effects of nitrogen dioxide remain unclear. A long-term standard for annual exposure to NO_2 has been set, and within

1 year a short-term (1- to 4-hour) standard is expected on the basis of new health impact information.[9] Generally such short-term standards require stricter control than annual average standards.

It is extremely difficult to generalize assumptions regarding future NO_x emissions, especially as they relate to stationary sources. The contribution of stationary sources to currently observed NO_2 levels must be determined on a region-specific basis. Future growth of stationary sources, powerplants in particular, will probably occur outside most urban regions. However, conversion to coal can increase NO_x emissions from existing oil- and gas-fired boilers. For these reasons CEQ assumed no net change in stationary source emissions—which is to say that growth will be offset by combustion controls and redistribution of sources. Growth of mobile source emissions and control factors were handled in a fashion similar to that for hydrocarbons and carbon monoxide.

For cars our emissions factor of 1.5 to 3.0 grams per mile includes deterioration and 2 percent growth. For trucks and buses only a net NO_x reduction of 15 percent was assumed.

Air quality projections based on the current annual average standard indicate that only Los Angeles will remain significantly above the standard in 1990. Boston, Chicago, and Philadelphia are expected to be slightly above the standard. Table 3 shows the 1975 and projected 1990 NO_2 levels for those cities where the annual standard (100 micrograms per cubic meter) is now being exceeded.

If the short-term standard, when it is established, bears the same relationship to long-term standards as it does for other criteria pollutants, it appears that the cities with annual standards problems—plus a few others—will have problems.

Control of nitrogen dioxide is important for two reasons. It may directly affect human health, and in addition its precursor, nitric

Table 3

Average Nitrogen Dioxide Concentrations, 10 Regions, 1975 and 1990

(micrograms per cubic meter)

Region	1975	1990
Baltimore	100	85
Birmingham	108	95
Boston	128	109
Chicago	131	115
Denver	97	81
Los Angeles	168	131
N.Y., N.J., Conn.	100	83
Philadelphia	124	110
Phoenix	109	86
San Diego	130	101

Source: Based on EPA's SAROAD system data.

oxide, is one element in smog formation. In some cities overcontrol of NO emissions may in fact upset the ozone control effort. A delicate balance exists among hydrocarbons, ozone, NO, and NO_2 in smog formation. Once hydrocarbons are reduced to achieve the oxidant standard, available models predict that under some circumstances further reductions in NO may increase ozone levels. Analysis to determine whether there is a conflict between meeting the present ozone standard and a stringent short-term NO_2 standard is imperative.

Sulfur Dioxide and TSP

Ambient air quality standards were originally set for sulfur dioxide and total suspended particulates because when they were together in high concentrations, health effects were measurable. More recent studies have demonstrated that a byproduct of sulfur dioxide emissions—sulfates—correlate better with the observed effects. EPA reports that less than 2 percent of all monitoring sites show violations of the annual and 24-hour SO_2 standard and 18 percent show excesses of the annual TSP standards. Only 6 percent of the stations recorded violations of the 24-hour standard.[10] Because the health effects were observed when both pollutants were present, the violation rate for TSP alone does not necessarily indicate adverse impacts on health. Although concurrent violations of the ambient standards for SO_2 and TSP have been greatly reduced, the sulfate problem still exists.

EPA is planning to establish a sulfate standard in 1981. Then we can assess the adequacy of current strategies to control SO_2 and TSP. The rapid conversion to greater use of coal must be carefully considered in this process. Scrubbers to control SO_x emissions from existing and future powerplants may not satisfy the requirements which may have to be imposed to meet a stringent sulfate standard. Some improvement in sulfate levels will follow the application of the best available control technology as long as growth remains within reasonable limits. As later discussion will show, SO_2 emissions contribute to the acid rain problem.

Other pollution problems that may follow increased coal use include the effects of NO_x, which are emitted in large quantities from coal-fired powerplants. Scrubbers do not control these emissions. They are converted to nitrate compounds in the atmosphere, the health implications of which have not been quantified. NO_x emissions, along with SO_2, also contribute to acid rain. Trace metals and organic particulate matter that can be carcinogenic also escape current particulate control devices. Special studies are underway by DOE and EPA to ascertain the potential impacts of these non-criteria pollutant emissions.

GLOBAL AND REGIONAL EFFECTS OF AIR POLLUTION

Our efforts to control air pollution have focused first on protecting human health in urban and industrial areas. Secondary—or welfare effects—standards to protect plants and materials and improve visibility in our urban environment have been established for all of the five criteria pollutants. Only in recent years have we been concerned with the broader spectrum of welfare effects of air pollution on a global and subglobal scale. Global welfare effects encompass impaired visibility of natural wonders, reduced productivity of agricultural land, forests, lakes, and rivers, climate changes, and indirect health impacts.

The progression of concern for the urban environment to concern for the global environment is natural. Obvious problems come first. Pollution control to protect health in urban centers and around industrial complexes may also alleviate some of the regional and global problems that are now becoming apparent. A key question is whether controls designed to protect health in cities are adequate against many of the welfare effects which have not yet been measured.

The same cause and effect assessments that led to establishment of the primary and secondary standards apply to welfare effects on a regional and global scale. We need to monitor for the suspect pollutants, inventory contributing sources, and measure effects. Only then can urban controls be evaluated for global and regional impacts and further measures developed. These large-scale assessments require far greater resources than the urban air studies. The sheer size of the study area indicates the magnitude of the assessment effort. Because many of the effects are subtle, monitoring instruments and biological activity measurements must be sophisticated and precise. Few of the required measurement tools have been developed, and models to relate sources and receptors on a regional or global scale are lacking.

Inventorying all sources of a given pollutant by location and strength is arduous, time consuming, and imprecise. Further, political and institutional problems may take years to resolve. And the costs of studying just one pollutant regionally or globally would be high.

Several global air pollution problems of international concern are the carbon dioxide "greenhouse" effect, the turbidity effect, and the potential depletion of the stratospheric ozone layer. A most important subglobal problem is acid rain in Scandinavia and North America.

The Greenhouse Effect

The temperature of the earth's atmosphere is determined primarily by the delicate balance between the amount of solar energy received from the sun and the amount reflected or returned to space. Gases in the atmosphere influence this balance. If carbon dioxide levels increase, the amount of energy leaving the earth may decrease, resulting in higher temperatures in the lower atmosphere. The potential environmental consequences are many.

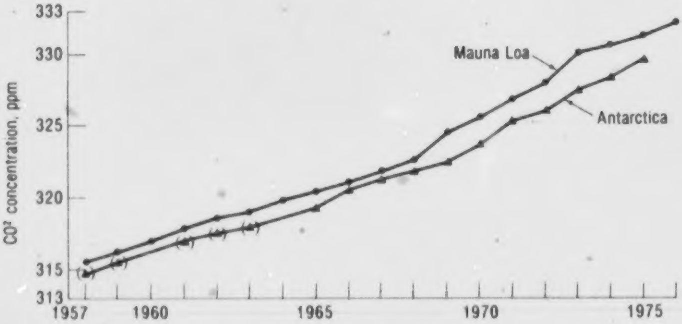
Most scientists believe that the observed increases in global CO_2 levels over the past 100 years are caused by increased consumption of fossil fuels; others believe that deforestation may have contributed at least as much to the global increases in carbon dioxide.[11] Whatever the cause, the potential effects are the same, although the small increase in temperature that would be expected from the recorded CO_2 increases over the past century has not been discerned.

The byproducts of fossil fuel combustion are carbon dioxide, water, and trace pollutants. The global emission of these byproducts has increased since the industrial revolution in direct proportion to our demand for energy. Deforestation, on the other hand, provides fuel, increases biological decay, and disturbs the soil—all of which increase CO_2 emissions. Deforestation also reduces the rate at which CO_2 is removed from the air. Upon release, carbon dioxide and water enter into the natural cycles which sustain life—the carbon and water cycles. The water cycle has been able to absorb the small increment of water caused by fossil fuel combustion, but carbon dioxide is different. A gradual increase in atmospheric CO_2 levels has been observed.

Accurate measurements have been made routinely at several background monitoring stations. The sites with the longest and best records are Mauna Loa, Hawaii, and the U.S. Observatory in Antarctica. Figure 14, trends of measured CO_2 levels since 1958 at these two sites, shows an increase of about 5 percent in 2 decades. Estimated global emissions of CO_2 are shown in Figure 15. The relationship between emissions and atmospheric levels of CO_2 is

Figure 14

CO_2 Air Quality Concentrations, Mauna Loa, Hawaii, and Antarctica



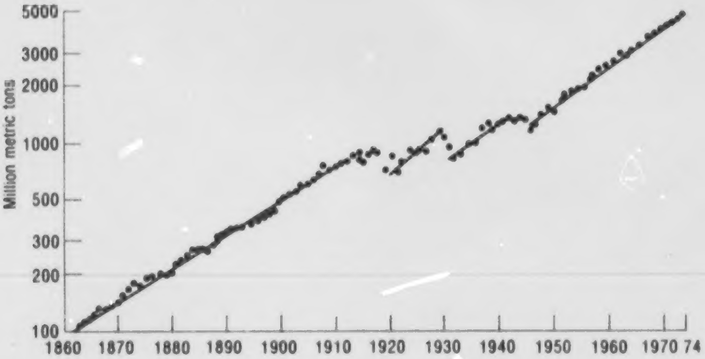
[1] Average annual concentration (based on Scripps 1974 manometric calibration).

[2] (▲) = average based on limited data.

Source: C. D. Keeling and R. B. Bacastow, "Impact of Industrial Gases on Climate," *Energy and Climate* (Washington, D.C.: National Academy of Sciences, 1977), p. 77.

Figure 15

Estimated CO_2 Global Emission Trends, 1860–1974



Source: C. F. Baes, Jr., H. E. Goeller, J. S. Olson, and R. M. Rotty, "Carbon Dioxide and Climate: The Uncontrolled Experiment," ***American Scientist*** **65:310, 311 (1977), based on data in C. D. Keeling, "Industrial Production of Carbon Dioxide from Fossil Fuels and Limestone,"** ***Tellus*** **25:174 (1973), and R. M. Rotty, "Global Carbon Dioxide Production from Fossil Fuels and Cement, A.D. 1950–A.D. 2000, presented at the Office of Naval Research Conference on the Fate of Fossil Fuel Carbonates, Honolulu, January 19–23, 1976.**

not one to one because of the complex interactions of CO_2 with the atmosphere, biosphere, and the oceans.

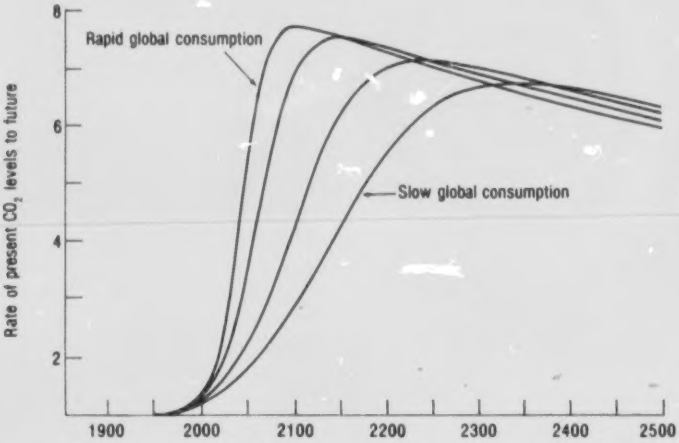
A model has been developed to predict CO_2 levels if changes in emissions and natural removal rates are known.[12]

Projected maximum CO_2 levels based on various assumptions about the rate of fossil fuel use do not differ very widely, regardless of the rate used. Only the date of attainment changes. Figure 16 illustrates these projections. If we use up the world's stores of fossil fuels at a rapid rate, the predicted CO_2 level will double by 2025 and reach a maximum of seven to eight times today's level by the year 2100. A doubling of the CO_2 level could cause a 2–3° C increase in average atmospheric temperatures. The most warming would occur at the poles; little change would be expected at the Equator (see Figure 17). It should be noted that these temperature predictions are quite uncertain; they assume no confounding effects such as changes in atmospheric turbidity, discussed below, or cloud response to the warming. A possible 2–3° C average temperature increase must be looked upon as a major global environmental threat—global temperatures over the past several thousand years have never fluctuated by more than about 1° C (Figure 18)—but the consequences are highly speculative.

With a general global warming trend, one would expect that current precipitation patterns would move to higher latitudes. Major agricultural belts, then, would shift poleward with obvious socioeconomic and political impacts. The warming of the polar regions

Figure 16

CO$_2$ Projections Using Four Fossil Fuel Consumption Rates, 1950–2500

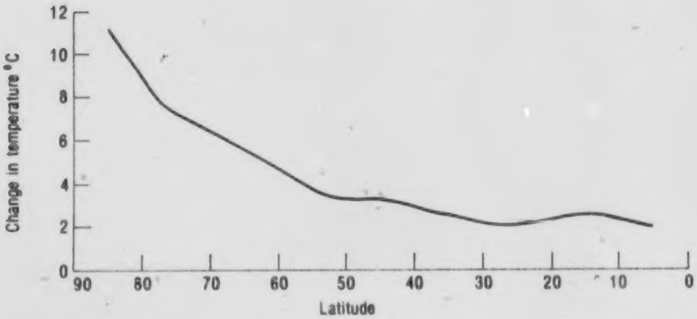


Source: C. D. Keeling and R. B. Bacastow, "Impact of Industrial Gases on Climate," *Energy and Climate* (Washington, D.C.: National Academy of Sciences, 1977), p. 77.

might promote melting of the polar ice caps and an associated rise in the sea level. Photosynthesis would be enhanced because of more rainfall and the more abundant CO$_2$.

Figure 17

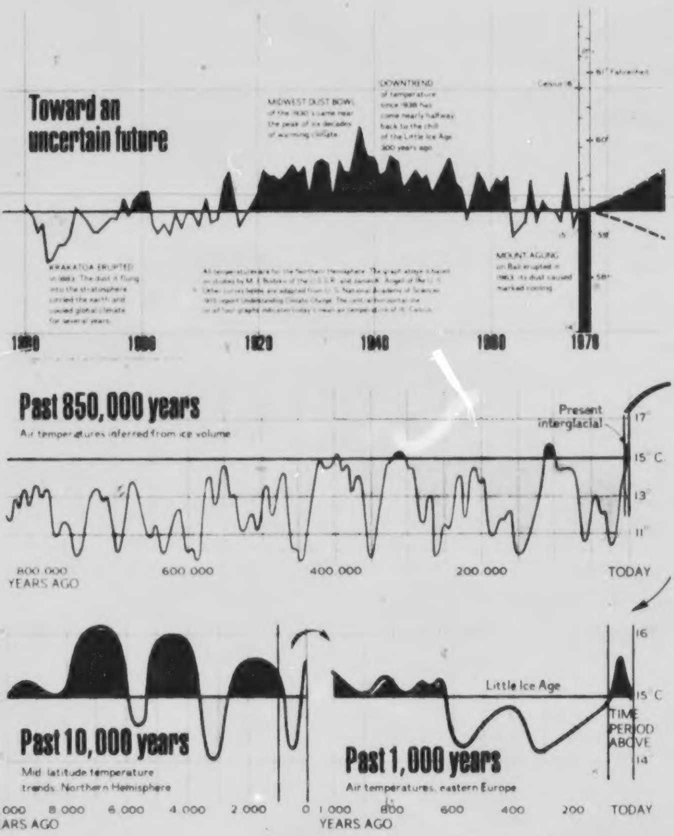
Estimated Effect of Doubling Atmospheric CO$_2$ on Surface Temperatures, by Latitude



Source: S. Manabe and R. T. Wetherald, "The Effect of Doubling the CO$_2$ Concentration on the Climate of a General Circulation Model," *Journal of Atmospheric Sciences* 32:3–15 (1975).

Figure 18

Global Temperature Trends



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The global CO_2 problem is an issue which must be addressed in terms of its relevance to national energy policies. If further research confirms the hypothesis just described, then a programmed switch from fossil fuels to energy sources with no associated CO_2 emissions—such as solar power—may be imperative in order to limit global temperatures. The CO_2 problem is being addressed by the Administration, which is budgeting approximately $1 million for studies in fiscal year 1978.

Atmospheric Turbidity

Atmospheric turbidity, which results from the increase in fine particles in the atmosphere, may be offsetting the CO_2 effect. Along with water vapor and water droplets, these particles reflect the sun's rays and therefore decrease the amount of solar energy reaching the earth. Turbidity is determined by comparing the sunlight measurement to what would be expected if the atmosphere were dust free. (Sunlight is measured quite simply with a sun photometer, which is similar to a photographic light meter.) Such measurements indicate that over the past years atmospheric turbidity has been increasing. Some studies have correlated this trend with the decline of global temperatures in the 25 years after World War II.[13]

Analyses conducted since 1970, however, show no clear global warming or cooling trend. It is possible that the warming that could have been expected from the 5 percent increase in CO_2 over the last 20 years was offset by increased turbidity. Now that we are controlling particulate sources, the predicted CO_2 effects may rapidly emerge, but this conclusion may be confounded by other unknowns. There are scientific arguments that low levels of sulfates and radioactivity from nuclear fuel processes can also adversely affect global climate.[14] As with the greenhouse effect, there are problems. A program which addresses the CO_2 issue must consider turbidity as well.

Fluorocarbons

Last year's Annual Report indicated that fluorocarbons—also called halocarbons, chlorofluoromethanes, and CFM's—may attack the earth's protective ozone layer, damaging human health, individual biological species, and ecological systems and possibly causing climatic change. Initial predictions of ozone depletion by fluorocarbons were made 3 years ago by scientists at the University of California.[15] Since then the problem has been extensively studied by the federal government, private industry, and the world's scientific community. A 1975 Federal Task Force on Inadvertent Modification of the Stratosphere (IMOS), led by CEQ and the Federal Council for Science and Technology, found that there was "legitimate cause for concern" and that fluorocarbons are likely to be the most important contributor to the problem.[16] The Department of Transportation's Climatic Impact Assessment Program, which studied the effects of high altitude aircraft emissions on the ozone layer, also reported possible threats to human health and biological systems resulting from increased solar ultraviolet radiation reaching the earth's surface.

The National Research Council of the National Academy of Sciences has stated: "All the evidence that we have examined indicates that the long-term release of F 11 and F 12 at present rates will cause an appreciable reduction in the amount of stratospheric ozone."[17] NAS's best estimate of the ultimate reduction of ozone to be expected, assuming 1973 levels of fluorocarbon production continued, was about

7 percent. NAS further stated that this stratospheric ozone change may have climatic as well as biological effects and that the accumulation of fluorocarbons in the lower atmosphere would alter infrared (heat) radiations, with possible further effects on climate. Fluorocarbons, which are widely used as spray can propellants and refrigerants, decompose in the presence of stratospheric UV (ultraviolet), releasing their chlorine compounds. These compounds upset the balance of ozone formation and decomposition, hastening decomposition without affecting formation and thus threatening the stability of the world's ozone layer.

Other pollutants may also contribute to the problem. Chlorine emissions from the planned NASA space shuttle and nitrogen oxides from SST aircraft have both been suspected as agents of possible ozone depletion. Nitrogen oxides resulting from high altitude thermonuclear testing and from fertilizers are other possible sources. Volcanoes, oceans, and other natural producers of nitrogen, chlorine, and bromine pollutants may also tend to deplete ozone. So may manmade chlorinated and brominated compounds. But the National Academy of Sciences concluded that manmade fluorocarbon sources are the main causes of concern, based on current knowledge.[18] If fluorocarbon emissions were drastically reduced within the next decade, ozone would continue to decrease, hence increasing the biologically damaging UV radiation, for at least a decade and would then take 50 years to decline to one-half its peak level.

For every 1 percent decrease in ozone, an increase in UV of about 2 percent will result. Because human health effects and damage to crops, livestock, and natural systems may result from long-term UV increases of only a few percent, predicted ozone decreases are clearly significant.

The primary effect of increased ultraviolet radiation intensities on human health is skin cancer. Both melanoma and less dangerous basal cell and squamous cell cancers have been implicated as probable effects by the National Cancer Institute. Recent monitoring of ground level UV at many U.S. sites revealed a close correlation with melanoma mortality.[19] The NAS believes that "the relation of solar UV radiation to melanoma ought to be taken as a likely health hazard of significant size and responded to accordingly." [20]

Other possible biological effects of UV increases are now under investigation through a coordinated interagency program at many universities and government laboratories.[21] Possible effects being studied relate to plant growth and development, including important farm and forage crops, nucleic acids and proteins and various molecular and cellular mechanisms, sensitive organs and larvae of animals and fish, insects and pathogens and their interactions with plants, and the photo avoidance and photorepair mechanisms available to plants and animals.

Very little is presently known about the effects of UV stress on natural ecosystems. Joint research on forests is beginning. Natural rangelands in the Southwest have been studied to a limited degree, and impacts on natural wetland ecosystems on the east coast are under investigation. In aquatic systems, ultraviolet radiation can penetrate the shallow waters where some fish and crustaceans spend their larval stages. Microscopic plants and animals—plankton, which form the basis of all oceanic productivity—could possibly be affected. The National Oceanic and Atmospheric Administration and several west coast institutes and universities are studying possible impacts on fisheries.

Potential fluorocarbon impacts on climate are very important. Fluorocarbons may prove second only to CO_2 emissions as a significant problem of global scale. It is known that fluorocarbons strongly absorb infrared radiation in the troposphere and so may alter heat balance and precipitation. Climate changes may also result from a reduced or redistributed ozone layer. Present monitoring and modeling efforts have not progressed far enough to give any definite answers in this direction, but careful study and analysis of fluorocarbon effects on climate are primary.

Fluorocarbon emissions are a worldwide problem. Because the United States is responsible for slightly less than one-half of all fluorocarbon emissions, a comprehensive attack on this world problem must be coordinated with other major fluorocarbon-producing nations. Coordination is being effected through the United Nations Organization for Economic Cooperation and Development and the Environment Program.

Acid Precipitation

Acid-causing pollutants from fossil fuel combustion are carried long distances with movements of air and are deposited by rain. In the last several decades precipitation in several areas of the world has been growing progressively more acidic.[22] The problem was first recognized in Scandinavia. Swedish investigators, analyzing precipitation monitoring data from European stations, found steady increases of sulfur and nitrogen compounds in rain and snowfall along with a closely correlated increase in acidity. An explicit pattern of increasing acidity (shown as decreasing pH) over a decade is shown on the Figure 19 maps.

A study by the Swedish Royal Ministry for Foreign Affairs[23] showed that in part the acid problem involved transport of pollutants into Sweden from other parts of Europe. Wind patterns during major rain and snowfalls coupled with high industrial emissions from north-central Europe made Scandinavia the victim of pollution originating elsewhere. In response, the United Nations Organization for Economic Cooperation and Development instituted a cooperative study on Long-Range Transport of Air Pollutants, involving 10 European countries and the monitoring of sulfur dioxide, sulfate, and strong acid concentrations at 70 stations in northern Europe.

Acid precipitation is a special threat to Scandinavia because forests

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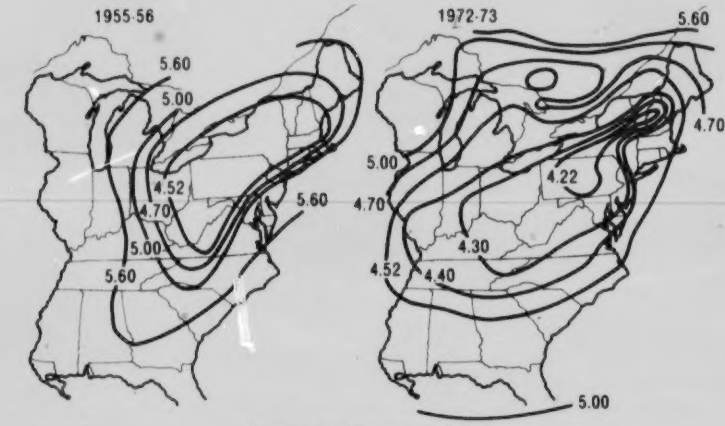
Figure 19

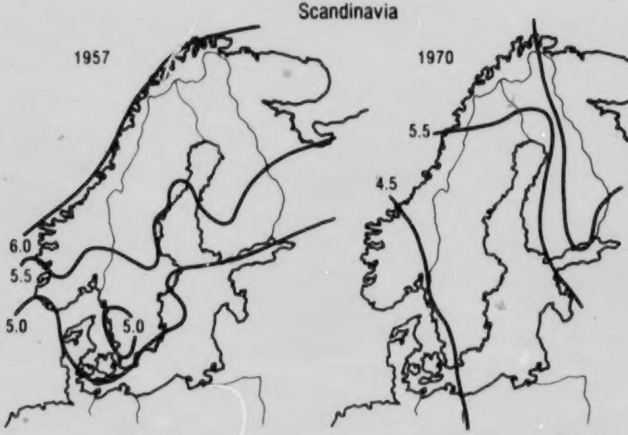
Precipitation Acidity (pH), Eastern United States, 1955–56 to 1972–73, and Scandinavia, 1957–70

Eastern United States


1955-56
5.60
5.00
4.52
4.70
5.00
5.60
5.60
1972-73
5.60
4.70
5.00
4.70
4.22
4.30
4.52
4.40
5.00

Average pH of annual precipitation

Scandinavia


1957
6.0
5.5
5.0
5.0
1970
5.5
4.5
6.0

Average pH from 12 monthly samples

Source: Gene E. Likens, "Acid Precipitation," *Chemical and Engineering News*, November 22, 1976, p. 31, reprinted with permission of the copyright owner, The American Chemical Society.

and fish are likely to be strongly affected. The International Conference on the Effects of Acid Precipitation, held in Norway in 1976 with the participation of UN agencies and 20 countries including the United States, identified damaging effects on forests, crops, fish, and materials such as steel and paint.

Recognition of the threat of acid precipitation in the United States has been slow. Even in the Northeast, where acid precipitation is known to be present, data are scanty. The changes in pH values from 1955–56 to 1972–73 are shown in Figure 19.

Research results indicate that strong mineral acids such as sulfuric and nitric acid are responsible for most of the acidity. The expected pH value for rain is about 5.7. Because each decrease in the pH by one integer indicates a 10-fold increase in acidity, an approximate reading of 4 pH (shown for the Philadelphia-Wilmington area) indicates almost 100 times the acidity of normal rainwater. It is thought that pollutant loadings from local northeastern sources add to the transported pollution from sources as far away as the midwestern states and southeastern Canada. The precipitation pH levels in the Midwest are relatively high because of the presence of calcareous soil particles picked up by the wind. These particles dissolve in the water droplets and neutralize acids which may be present.

Other parts of the United States may also have local or regional acid rainfall. Studies have shown acidic conditions in Maryland, Michigan, Ohio, Missouri, Texas, and Washington.[24] Many acidity problems result from local sources. Smelters and powerplants can contribute to acid conditions as far as several hundred miles away. Sulfates and nitrates from urban emissions are important in some regions; natural sources such as volcanoes and oceans are significant in others.

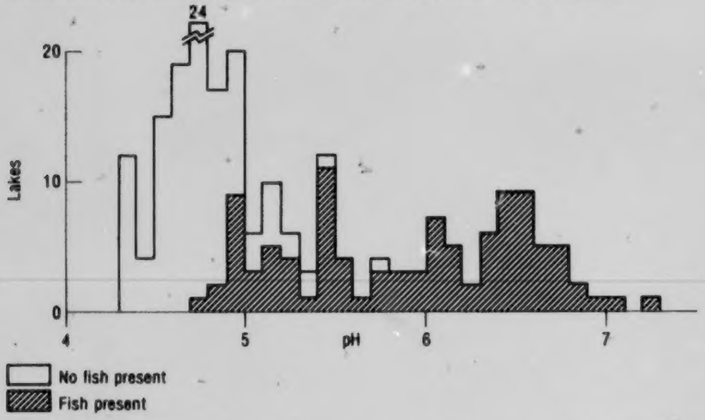
Although the impacts of acid precipitation have not been fully evaluated, studies in Europe, Canada, the U.S.S.R., and the northeastern United States have shown these adverse effects:

- Decreases in agricultural and forest yields
- Decreases in freshwater fish production
- Depletion of nutrients from soils or aquatic ecosystems
- Inactivation of important microorganisms
- Corrosion or deterioration of materials.

Local conditions as well as levels of pollution determine the magnitude of these effects. For example, the soil in Scandinavia is highly susceptible to acid effects because of its low buffering capacity. Soils, such as those in our Northeast with a high calcium and magnesium content, can neutralize or buffer acid effects. Such areas may not suffer the severe problem found in Scandinavia. This possibility has not yet been confirmed.

Figure 20

Frequency Distribution of pH and Fish Populations in Adirondack Mountain Lakes above 2,000 Feet, 1975



Source: C.L. Shofield, "Acid Precipitation: Effects on Fish," *Ambio* 5 (5–6): 229 (1976).

The most strongly affected systems tend to be high altitude forests, streams, and lakes, a finding which suggests a serious long-range threat to many National Forests and National Parks. Acid conditions in lakes or streams often cause failure in fish spawning, particularly for trout and salmon species.[25] Figure 20 shows reductions in fish populations in high altitude acidified lakes in the Adirondack Mountains, New York.

Leaching of important nutrients from soils and depletion of nutrient availability in streams and lakes are subtle but important mechanisms by which acid precipitation damages agriculture, forestry, and natural resources. A portion of the strong acids tends to bind chemically to nutrient ions and make them unavailable to plants and animals. Important microorganisms are also affected—plankton, which are the foundation of freshwater food chains, and nitrogen-fixing algae and bacteria, which help to replenish soil nitrogen and aid in the growth of many trees and agricultural crops.

A comprehensive national program to assess the acid rain problem needs to be developed. Current SO_2 and NO_2 standards are directed at protecting health in urban or industrial environments. Standards related to acid precipitation are lacking because definitive assessment information does not yet exist. Much more effort should be devoted to this problem in view of the fact that we are looking to coal as a major energy source. Coal use will mostly increase emissions of sulfur and nitrogen oxides, unless they are controlled. The potential adverse effects and costs to society of acid precipitation deserve prompt attention.

WATER QUALITY

Every citizen has a personal stake in the quality of the nation's waters. We need water that is safe to drink, safe to swim in, habitable for aquatic life, free of nuisance conditions, and usable for agriculture and industry. Health, jobs, and the quality of our lives are thus affected in many ways by water quality.

In recent years we have launched efforts on an unprecedented scale to restore and protect water quality, and predictably we encountered difficulties as well as successes. The national effort is behind the original schedule, and the emerging and still unsolved problems are considerable, but there is cause for encouragement in the many important accomplishments achieved thus far.

The nation's primary water quality goal, established by the 1972 Federal Water Pollution Control Act Amendments,[26] is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The immediate goal is to achieve "water quality which provides for the protection and propagation of fish, shellfish, and wildlife, and provides for recreation in and on the water," wherever attainable, by 1983—the "fishable and swimmable waters" goal, as it is commonly known. In addition, the nation needs sufficient water supplies of suitable quality for many domestic, industrial, and agricultural uses. Ecological and esthetic considerations also count heavily.

The Act set an interim deadline of July 1, 1977, for nationwide application of secondary treatment to municipal sewage and "best practicable" technology to control water pollution from all industrial disharges. Considerable progress has been made toward this goal, but as has long been expected, we did not meet the deadline for either municipal or industrial discharges.

According to current EPA estimates, only about 30 percent of the nation's 13,000 municipal treatment plants provided secondary treatment by mid-1977,[27] although all $18 billion authorized for construction of municipal sewage facilities was scheduled to be obligated by September 1977 (see the section on water in Chapter 1).

Control of water pollution from industrial discharges is doing better. An estimated 3,400 of the nation's 4,000 major industrial dischargers complied with the 1977 deadline, and most of the remaining 600 are moving toward compliance.[28] Every industrial pollution source is required to have a permit limiting its discharge. The permits are issued by EPA under the National Pollution Discharge Elimination System (NPDES) or by states that have assumed this responsibility. The permits reflect EPA's effluent guidelines and "best practicable" control technology requirements that have been set for each type of industry.

Even if the 1977 deadlines had been fully met, the 1983 "fishable and swimmable waters" goal and other water quality needs are a long way away. Abatement of water pollution from municipal and industrial point sources is critical, the most important task in many areas, but nonpoint (diffuse) sources—such as surface runoff from agricultural and urban land—are also very important causes of water quality degradation. In some central and western states, nonpoint sources are even more important than point sources.

Montana, for example, recently estimated that only about 100 of its 4,000 stream miles with water quality problems would be improved by further point source abatement. In Arizona, out of six river segments that currently fail to meet water quality standards, none would improve significantly with better point source controls, according to state estimates.[29]

On the other hand, even though the nation's water pollution control efforts are behind schedule and face some difficult problems, it is important to recognize that a great deal has already been accomplished. Table 4 lists 50 water bodies that have been greatly improved since the 1960's through federal, state, municipal, or private efforts. Some of the improvements are described below.

- Swimming, fishing, and canoeing are now possible in a 55-mile stretch of New Hampshire's Pemigewasset River that had been in a nuisance condition in the 1960's. With recent upgrading of six municipal treatment plants and better operation of an industrial waste water treatment facility, the summer tourist industry in the Pemigewasset basin is now flourishing.
- Fish have returned to western Connecticut's Naugatuck River, even where no aquatic life could survive in the 1950's. Thanks to the installation and upgrading of industrial and municipal treatment facilities, 1975 samplings revealed smallmouth bass, bluegills, and other fish.
- Pollution-sensitive fish such as bass, walleye, and perch are increasing in the lower Mohawk River, which flows through the heavily populated and industrialized Utica-Rome area on its way to the Hudson. Before 1972, Utica and other municipalities discharged raw wastes into the river, frequently in violation of bacterial and dissolved oxygen standards. Today the number of violations is greatly reduced, more than 75 percent of the industrial wastes discharged into the Mohawk are now treated, and further improvements are scheduled.
- North Carolina's French Broad River is much cleaner, and fish have reappeared as a result of industrial water pollution abatement. In the 1950's, there were heavy loadings of organic material, metals, and other pollutants, and parts of the river were black, malodorous, foam covered, and nearly devoid of oxygen. New waste treatment facilities and process changes by the Olin Corporation and the American Enka Corporation are responsible for reduced organic loads and higher dissolved oxygen levels. The water is no longer black, the foam and foul odors have disappeared, and the river now supports tolerant aquatic life.

Table 4

Improvement in 50 U.S. Water Bodies

Water body	State
Anabessacook Lake	Maine
Androscoggin River	Maine
Contoocook River	New Hampshire
Pemigewasset River	New Hampshire
Winooski River	Vermont
Lake Quinsigamond	Massachusetts
Naugatuck River	Connecticut
Willimantic River	Connecticut
Buffalo River	New York
Mohawk River	New York
Susquehanna River	New York
Hackensack River	New Jersey
Navesink River	New Jersey
Shrewsbury River	New Jersey
Monongahela River	Pennsylvania-West Virginia
Kanawha River	West Virginia
Ohio River	Six states
French Broad River	North Carolina
Charleston Harbor	South Carolina
Savannah River	South Carolina-Georgia
Sope Creek	Georgia
Escambia Bay	Florida
Mobile-Tombigbee Rivers	Alabama
Escatawpa River	Mississippi
Pearl River	Mississippi
Detroit River	Michigan
Kalamazoo River	Michigan
Grand Calumet River	Indiana
Salt Creek	Indiana
Trail Creek	Indiana
Calumet River	Illinois
Fox River	Wisconsin
Maunesha River	Wisconsin
Lake Minnetonka	Minnesota
Lake Shagawa	Minnesota
Dry Auglaize Creek	Missouri
Arkansas River	Arkansas-Oklahoma
Little Deep Fork	Oklahoma
Tar Creek	Oklahoma
Bogue Lusa Creek	Louisiana
Neches River	Texas
Houston Ship Channel	Texas
Las Vegas Wash	Nevada
Willamette River	Oregon
Grays Harbor	Washington
Port Angeles Harbor	Washington
Campbell Creek	Alaska
Chester Creek	Alaska
Kodiak Harbor	Alaska
Pearl Harbor	Hawaii

Source: Environmental Protection Agency, *Pollution Control in the U.S.—Some Examples of Recent Accomplishments* (Washington, D.C.: Government Printing Office, 1976), pp. 7–11, 14–17, 19–27, 32–41, 45–55, 60, 67, 71, 120, 122.

- The Savannah River, one of the most important waterways in the southeastern United States, has also been the scene of successful cleanup. Aquatic life is recovering, and fish are reappearing in parts of the river where they have not been found in years. A 1963 federal study conducted in response to citizen complaints indicated that the lower 22 miles of the river were severely degraded by discharges of raw sewage, industrial waste, and cooling water. The Savannah's commercial fishing industry was in trouble, with approximately 11 thousand acres of coastal waters closed to shellfishing. Today all the major dischargers on the lower river have constructed waste treatment facilities.[30]
- State water quality standards for protection of aquatic life are now being met throughout Alabama's lower Tombigbee River, including a 5-mile stretch near McIntosh that was once known as the "fish kill capital of Alabama." In 1975, the state took legal action against dischargers of pesticides and other toxic organic chemicals. Since 1974, all industrial waste water has been treated and more than 85 percent of the organic chemicals removed. Bass have reappeared in the 5-mile stretch below McIntosh, and no serious fish kills have been reported recently.
- The Detroit River is one of the nation's best-known successes in water pollution abatement. Fishermen are now catching walleye, pike, muskellunge, smallmouth bass, coho salmon, brown trout, sturgeon, and perch. In the 1950's and early 1960's, it was considered a dead river, having become a dump for sewage, chemicals, oil, acid, garbage, and paper sludge. Much of the shoreline was covered with a quarter-inch film of oil, and large grease balls were commonly washed ashore. Tons of phosphorus were discharged daily into the river, eventually reaching Lake Erie. The Detroit's main tributary, the River Rouge, was colored orange by the acid pickle liquor from steel processing operations. Aquatic life was drastically diminished, and thousands of ducks were killed each winter when they landed on openings in the ice. There have been no major duck kills since 1968, and although the Detroit is by no means a clean stream yet, the improvements from municipal and industrial pollution control have been substantial. Total oil and grease loadings were cut an estimated 82 percent between 1963 and 1975, and the oil-covered shoreline is almost clean today.[31] Phosphorus and sewage discharges have been greatly reduced.
- The Arkansas River now meets standards for public and industrial water supply, fishing, wildlife propagation, and agricultural uses, and much of the river is now clean enough for swimming. This represents quite a comeback from 1955, when the Arkansas-White-Red Basin Interagency Committee reported that the river had been abandoned for any beneficial use and was suitable only for transporting wastes. The improvements are a result of federal, state, and local cooperative efforts that provided new and up-

graded municipal and industrial waste treatment facilities as well as a project to provide stream flow augmentation and riverbank stabilization to reduce sediment runoff.[32]

- Pearl Harbor is open to the public for swimming, boating, and fishing for the first time since World War II. As recently as the late 1960's, more than 4 million gallons of raw sewage and over 3 million gallons of primary-treated sewage were discharged daily by the U.S. Navy and neighboring municipalities. Oyster beds were contaminated by sewage, and the harbor was closed to the public. In response to a 1970 Executive order requiring federal facilities to meet environmental standards, new treatment facilities were constructed. No raw sewage is now being discharged into Pearl Harbor.[33]

These and other examples listed in Table 4 are unmistakable and heartening evidence that water pollution abatement is paying off—with valuable results. However, to understand the full range of water quality problems facing the nation, we need to consider them from several perspectives. The following water quality assessments are based on analyses by the Council, other federal and state agencies, and nongovernment researchers. The topics that we cover this year include: sanitary water quality and municipal sewage treatment, oil spills, pesticides, other toxic water pollutants, and pollution problems of the Great Lakes.

SANITARY WATER QUALITY AND MUNICIPAL SEWAGE TREATMENT

The water quality problem most often reported nationwide is excessive fecal bacterial levels that interfere with the recreational uses of water bodies. Although not harmful by themselves, coliform bacteria have traditionally been used as indicators of sewage contamination and the possible presence of microbial pathogens that are hazardous to human health.

Coliform bacterial problems are most prevalent near urban areas and in streams where flow rates are sometimes too low to dilute human or livestock wasteloads. The main sources of waterborne coliform bacteria are inadequate municipal and private sewage systems, urban stormwater and combined sewer overflows, and surface runoff from feedlots and grazing lands.

A gross overview of the geographic distribution of fecal coliform bacterial levels in major U.S. streams may be seen through data from the National Stream Quality Accounting Network (NASQAN) of the U.S. Geological Survey.[34] NASQAN collects uniform data at the downstream ends of 334 subregional drainage basins that collectively cover the entire surface of the nation. The network has been in full operation since the beginning of the 1975 Water Year (October 1, 1974 to September 30, 1975).

Figure 21

Fecal Coliform Bacteria in U.S. Streams, 1975–76

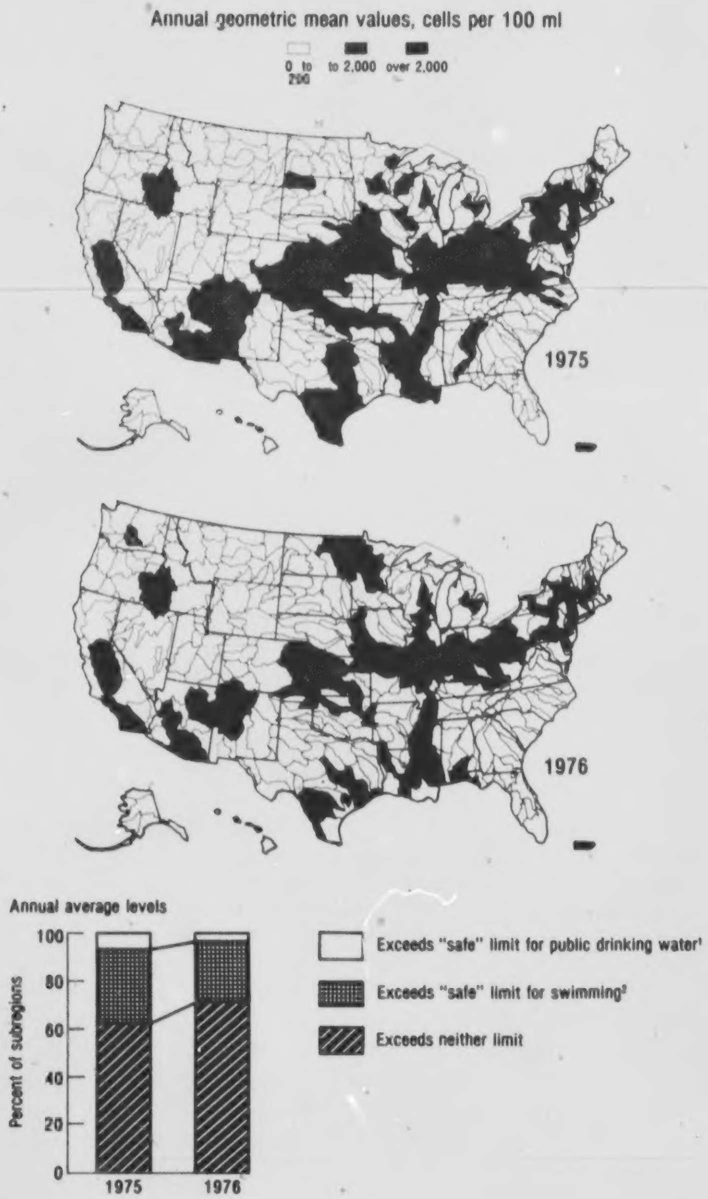
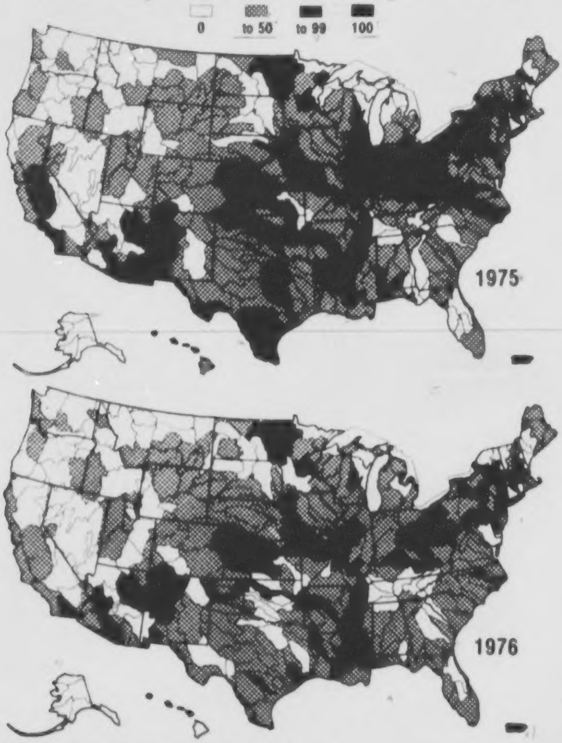
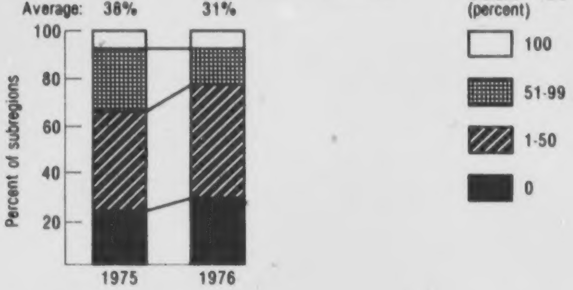

Annual geometric mean values, cells per 100 ml
0 to 200
to 2,000
over 2,000
1975
1976
Annual average levels
Percent of subregions
100
80
60
40
20
0
1975
1976
Exceeds "safe" limit for public drinking water[1]
Exceeds "safe" limit for swimming[2]
Exceeds neither limit

Figure 21 (continued)

Annual violation rate, percent above 200 cells per 100 ml



Annual violation rate for the "safe" limit for swimming[3]



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[1] 2,000 cells per 100 milliliters.

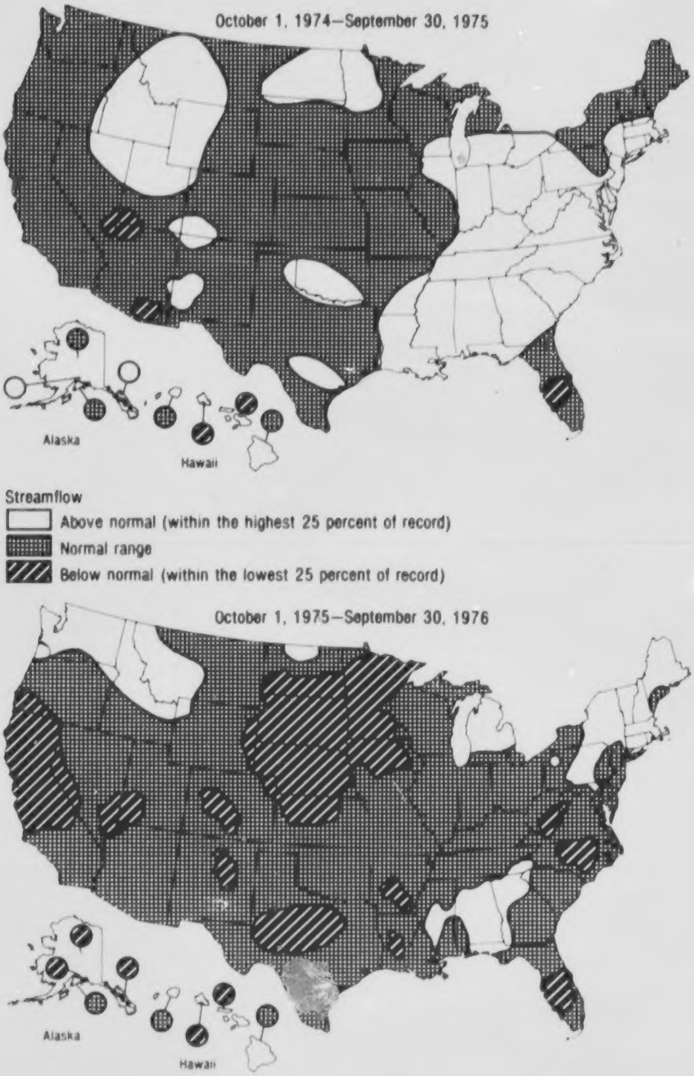
[2] 200 cells per 100 milliliters.

[3] Violation rate = percent of observations which exceeded the benchmark level of 200 cells per 100 milliliters.

Sources: For drinking water, National Academy of Sciences, *Water Quality Criteria*, 1972; for swimming, U.S. Environmental Protection Agency, *Quality Criteria for Water*, 1976.

Figure 22

Streamflow during Water Years 1975 and 1976 (Annual Runoff)


October 1, 1974—September 30, 1975
Alaska
Hawaii
Streamflow
Above normal (within the highest 25 percent of record)
Normal range
Below normal (within the lowest 25 percent of record)
October 1, 1975—September 30, 1976
Alaska
Hawaii

Source: U.S. Department of the Interior, U.S. Geological Survey, *Water Resources Review*, September 1975, p. 16, and September 1976, p. 14.

The left-hand maps in Figure 21 show the annual average (geometric mean) values* for fecal coliform bacteria in major streams in 1975 and 1976. The shaded areas indicate the subregions where the average bacterial levels measured during the year exceeded the water quality criterion for safe swimming.[35] The darker portions show the worst areas, where the average bacterial levels also exceeded the reference level for waters that are used as sources for public water supply, which is 10 times higher than the criterion for swimming.[36]

If the *average* value in a subregion exceeds a safe limit, then violations of that limit must be occurring frequently. The right-hand maps in Figure 21 show the annual "violation rates"** for the safe swimming limit—that is, the percentage of measurement taken throughout the year that exceeded the limit. It is evident that many parts of the country experience bacterial contamination of streams at least part of the time.

In summary, Figure 21 shows that in 1976, the average bacterial levels exceeded the limit for safe swimming at stream monitoring sites that represent 29 percent of the nation's subregions. In addition, 72 percent of the subregional sites violated the limit at least part of the time, and 24 percent violated the limit most of the time.

These 1976 conditions are an apparent improvement over 1975, also shown in Figure 21. In 1975, the average levels exceeded the safe swimming limit in 38 percent of the subregions, and violations were reported at 78 percent of the sites, with 35 percent exceeding the limit most of the time. A hard core of 8 percent of the subregions were in violation of the limit 100 percent of the time in both 1975 and 1976.

For all 334 NASQAN subregions, the average violation rates for fecal coliform bacteria were 38 percent in 1975 and 31 percent in 1976. A 2-year "trend" for any water quality measure cannot be evaluated with confidence, of course, because of year-to-year variations in precipitation and rates of streamflow. Yet it should be noted that the overall rates of streamflow for most parts of the country were generally *lower* in 1976 than in 1975, providing *less* dilution of sanitary wasteloads (Figure 22). In the majority of subregions that showed improvement in fecal coliform counts, the 1976 annual mean flow rates at representative NASQAN sites were also generally lower than 1975 flows. In 30 of 41 improving subregions for which complete streamflow data are available, the mean flows were actually lower in 1976 than in 1975. Thus, although we cannot discount the possible impact of combined sewer overflow in a few areas, it appears that the improvements are not simply a function of dilution.

The first 2 years of full operation of the NASQAN system coincided with construction of municipal sewage treatment facilities and other abatement action at a pace that is unprecedented in the nation's history. In short, the NASQAN data are encouraging. Future data will tell us to what extent the apparent improvements from 1975 to 1976 represent genuine trends. However, it may take several years to obtain firm evidence, especially because late 1976 and early 1977 streamflow rates were abnormally low for much of the country, as shown in Figure 23. Some water pollution variables reached record levels in parts of California, Colorado, Minnesota, North and South Dakota, Ohio, and elsewhere during early 1977 because of drought.[37] The usefulness of 1977 data for assessment of water quality trends in many parts of the country, then, is limited.

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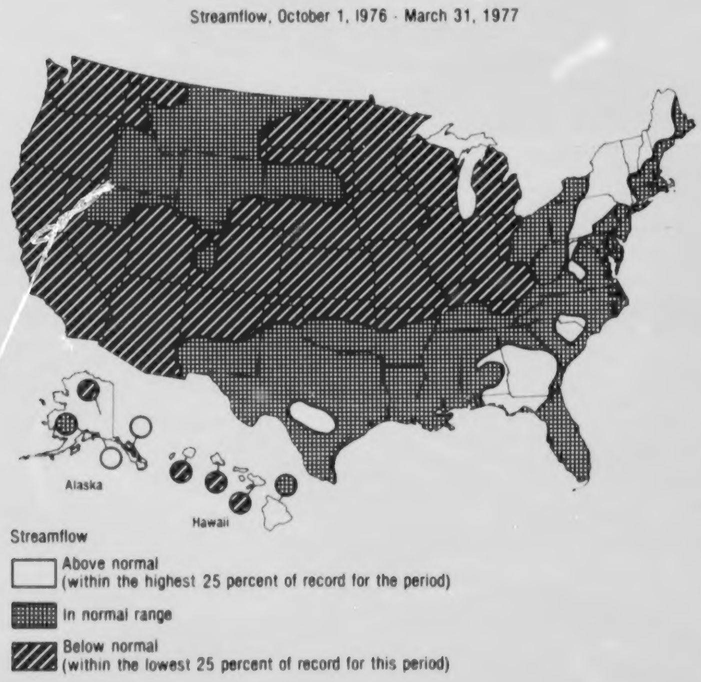
*Defined as the antilog of the mean of the $\log_{10}$ values.

**The term "violation' as used here does not necessarily imply legal significance; local laws and standards sometimes differ from the nationally recommended criteria.

A more detailed assessment and longer-term trends may be seen in a recent CEQ-EPA analysis of sanitary water quality and sewage treatment in 25 U.S. municipal areas from 1968 to 1976. The areas chosen for the study are shown in Figure 24. Improvements were not

Figure 23

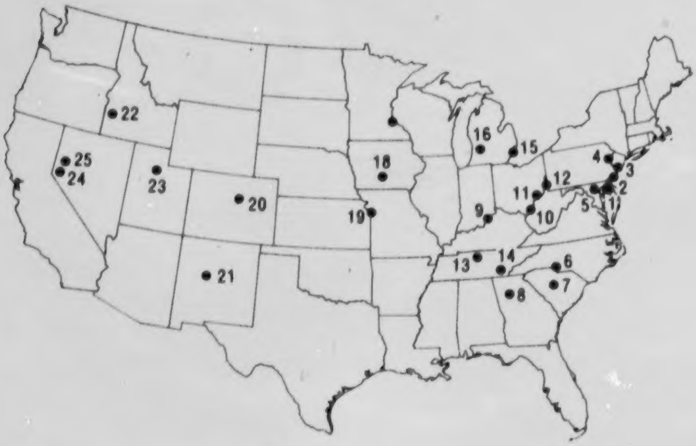
Streamflow for 6 Months Ending March 31, 1977


Streamflow, October 1, 1976 - March 31, 1977
Alaska
Hawaii
Streamflow
Above normal (within the highest 25 percent of record for the period)
In normal range
Below normal (within the lowest 25 percent of record for this period)

Source: Department of the Interior, U.S. Geological Survey, *Water Resources Review*, April 1977, p. 17.

Figure 24

Municipal Areas Included in the CEQ-EPA Study of Sanitary Water Quality, 1968–76



River		Municipal area
Delaware	1	Wilmington, Del.
Delaware	2	Philadelphia, Pa.; Camden N.J.
Delaware	3	Trenton, N.J.
Delaware	4	Easton, Lehigh, Bethlehem, Allentown, Pa.
Monocacy	5	Frederick, Md.
Sugar Creek	6	Charlotte, N.C.
Congaree	7	Columbia, S.C.
Chattahoochee	8	Atlanta, Ga.
Ohio	9	Louisville, Ky.
Ohio	10	Huntington, W.Va.
Ohio	11	Marietta, Ohio; Parkersburg, W.Va.
Ohio	12	Wheeling, W.Va.
Cumberland	13	Nashville, Tenn.
Tennessee	14	Chattanooga, Tenn.
Detroit	15	Detroit, Mich.
Grand	16	Grand Rapids, Mich.
Mississippi	17	Minneapolis, St. Paul, Minn.
Des Moines	18	Des Moines, Iowa
Missouri	19	Kansas City, Independence, Mo.
South Platte	20	Denver, Colo.
Rio Grande	21	Albuquerque, N. Mex.
Boise	22	Boise, Idaho
Jordan	23	Salt Lake City, Utah
Carson	24	Carson City, Nev.
Truckee	25	Reno, Nev.

altogether consistent, but in general the trend was toward better sanitary water quality. Downstream of the cities, however, the fecal coliform bacterial counts more often than not still exceed the limit for safe swimming.

The 25 study areas include a total population of 22.4 million (1970 census). In choosing them, we wanted a representative cross section of the nation's municipal areas. However, an important factor in the selection was the adequacy of water quality data in EPA's computerized STORET data bank, and such data often tend to be more plentiful in cities with well-known water pollution problems.

Despite the possible bias, the 25 study areas do not appear to deviate greatly from corresponding national averages. For example, their 1974–76 combined average violation rate for fecal coliform bacteria was 53 percent downstream of the cities and 34 percent upstream, which is not out of line with the average violation rate of 35 percent for 1975–76, as measured at the NASQAN subregional monitoring sites. Likewise, in 1976, about 58 percent of the combined total sewage flow in the 25 municipal study areas was receiving secondary or better treatment. This figure is comparable with a recent estimate that roughly 30 percent of the nation's treatment plants provided secondary treatment by 1977, given that the estimate includes small municipalities which are generally less likely to have secondary treatment facilities.[*]

Water quality data from a total of 100 monitoring sites were analyzed in the study, an average of 4 sites per city. The total includes upstream and downstream stations as well as some sites within the cities. Both the monitoring sites and the data were screened in consultation with EPA regional personnel for adequacy of the variables measured, measurement frequency, period of record, geographic location, and other criteria. CEQ's new computerized UPGRADE system was used to analyze the data.

Several other variables besides coliform bacteria—chiefly dissolved oxygen and biochemical oxygen demand (BOD)—were considered in the water quality analyses for the 25 study areas. Dissolved oxygen can be depleted by decomposition of oxygen-demanding organic materials, often measured in terms of BOD. With severe organic pollution, dissolved oxygen levels can fall low enough to make the water uninhabitable for pollution-sensitive species, even causing fish kills and foul odors. Oxygen depletion can occur naturally, as in swamps or under winter's ice cover, but most of the severe oxygen depletion problems in the 25 study areas are caused by municipal sewage, industrial discharges, and surface runoff from urban land. Runoff can become an important problem when brief rains wash organic contaminants into waterways, especially during periods of generally low streamflow.

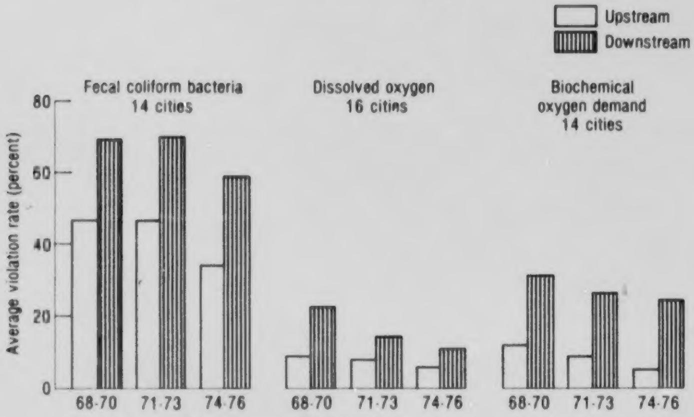
Sanitary Water Quality in 25 Study Areas

Figure 25 summarizes the trends in average violation rates for three of the major sanitary water quality variables: fecal coliform bacteria, dissolved oxygen, and biochemical oxygen demand. Because unusual streamflow conditions in any single year can affect pollution levels and obscure a trend, the data are combined into three 3-year periods: 1968–70, 1971–73, and 1974–76. Average violation rates upstream of the cities indicate the impacts of pollution sources above each study area; downstream violation rates show the combined impact of the upstream sources and of the city.

Figure 25 makes several points: First, the safe swimming limit for fecal coliform bacteria is often violated—more than one-half the time downstream, on the average, for all study areas. Violations of the benchmark limits for dissolved oxygen and biochemical oxygen demand are much less frequent and occur generally in the heavily polluted municipal waterways. Average violation rates downstream of the cities, as expected, are worse than upstream rates for every variable and every time period. All three sanitary variables have improved since 1968, especially downstream of the municipal study areas.

Figure 25

Sanitary Water Quality, Average Violation Rates,[1] 1968–76



[1] Percent of observations which exceeded the benchmark level of 200 cells per 100 milliliters for fecal coliform bacteria, or which fell below the benchmark level of 5.0 milligrams per liter for dissolved oxygen, or which exceeded the benchmark level of 5.0 milligrams per liter for biochemical oxygen demand.

Source: UPGRADE, based on EPA's STORET system data.

Figures 26, 27, and 28 show the 1968–76 violation rates for the same three sanitary water quality variables at each study area. City by city, the areas showing improvement outnumbered the areas showing degradation by a substantial margin. Downstream data for all three variables were available for 22 of the study areas; 12 showed significant improvement or no change in all variables, 1 showed significant degradation or no change in all variables, and the other 9 had mixed results.

Despite these improvements, widespread problems remain, especially with fecal coliform bacteria. The safe swimming limit was exceeded at least part of the time at every downstream station in every municipal area—not surprising in view of the fact that the average 25-city downstream violation rate for 1974–76 was 57 percent. For only the two Nevada cities were downstream violation rates less than 25 percent. Eight of the municipal areas showed extreme problems, with bacterial violations occurring over 75 percent of the time: Albuquerque; Atlanta; Charlotte, North Carolina; Des Moines; Kansas City, Missouri; Louisville; Philadelphia; and Salt Lake City.

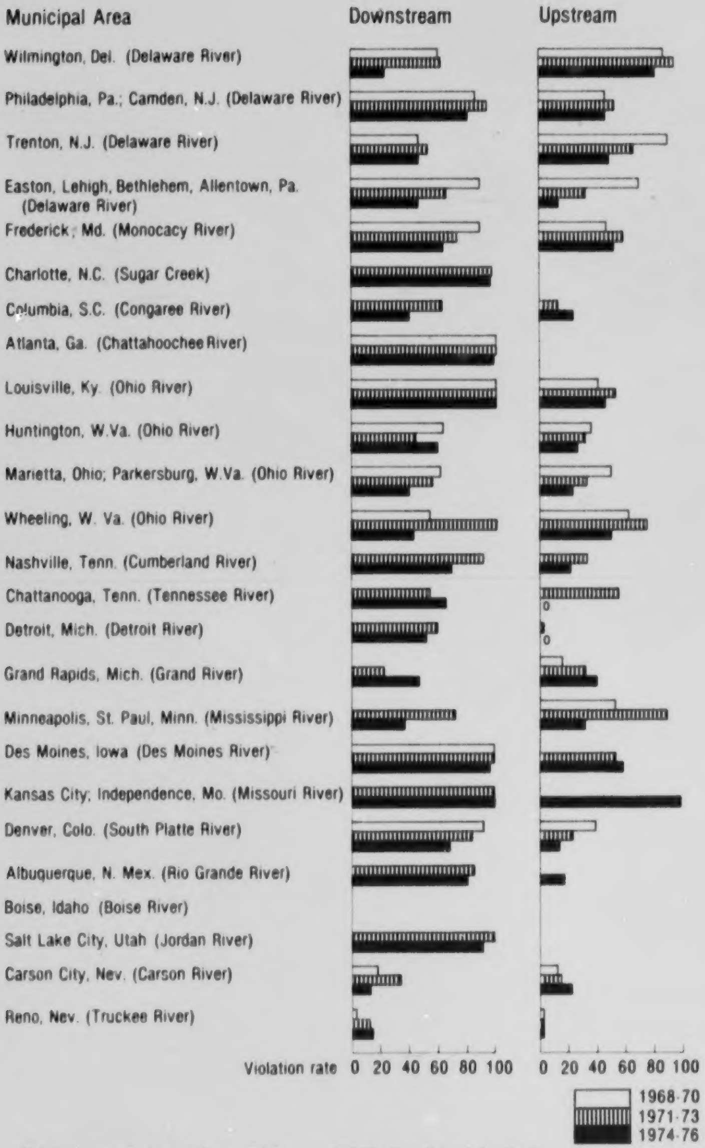
The trends were improving, however, in most of the cities where data were sufficient for trend analysis. Comparing the 1968–73 with the 1974–76 data, violation rates for bacterial levels declined downstream in 18 of the cities, increased in 4 cities, and were unchanged in 2 (see Figures 26 and 29). Overall, the average change was a 10 percent reduction in the violation rate. The downstream changes were statistically significant at the 90 percent confidence level in 9 of the study areas that showed improvement and in only 1 of the worsening areas (Figure 29). Brief surveys conducted prior to consistent monitoring practice suggest that even this significantly worsening area may once have been far more polluted.

Fecal coliform bacterial levels also generally improved upstream of the municipal study areas, although not so dramatically as downstream. These upstream improvements reflect abatement actions taken elsewhere in the watersheds. Thirteen of the 19 cities with adequate upstream data showed improving trends over the 9-year period, 5 showed degradation, and 1 did not change. However, only 6 of the upstream improving trends were statistically significant at the 90 percent level of confidence (Figure 29). A further indication that the upstream improvements were generally less significant than the downstream gains is that the difference between downstream and upstream violation rates (one measure of a city's impact) was less for 1974–76 than it was for 1968–73 in 10 of the 15 cities for which the data make such a comparison possible. This difference means that the downstream stations in general were improving more or in a few cases degrading less than the upstream stations.

For dissolved oxygen, most of the municipal study areas had low violation rates—below 10 percent during the entire 9 years on the large streams evaluated in our study (Figure 27). Only 6 cities showed a violation rate higher than 10 percent for any time period in the

Figure 26

Fecal Coliform Bacteria, Mean Violation Rates,[1] 1968–76

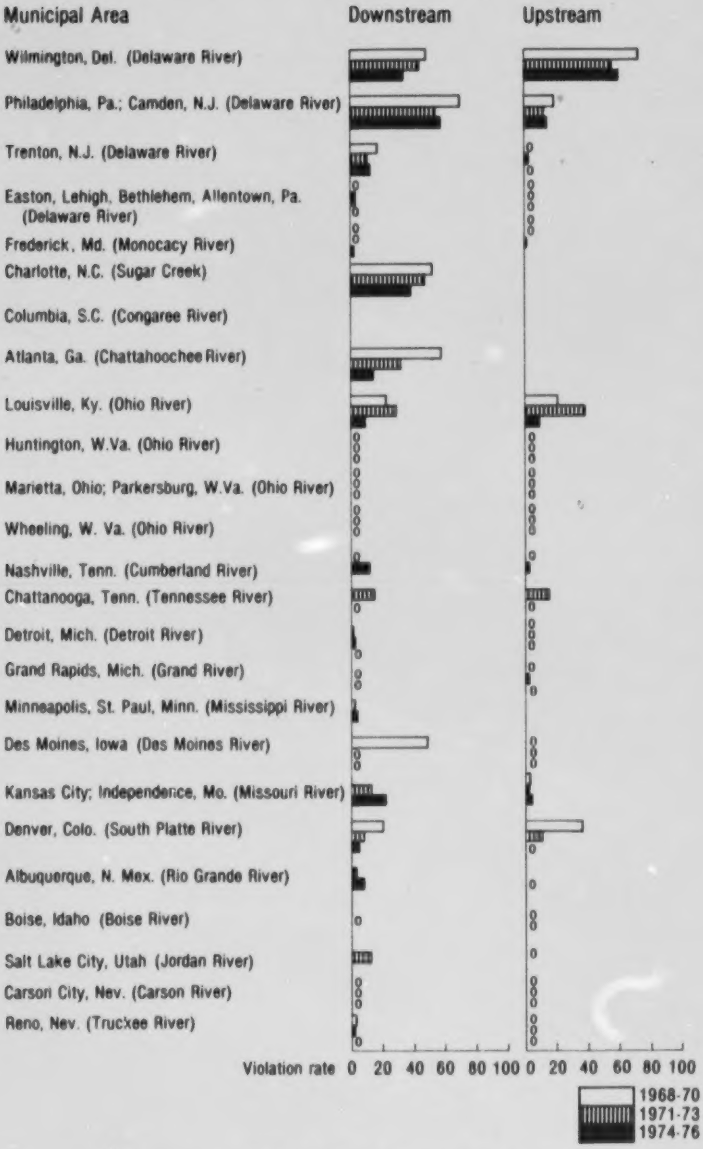


[1] Percentage of observations which exceeded the benchmark level of 200 cells per 100 milliliters.

Source: UPGRADE, based on EPA's STORET system data.

Figure 27

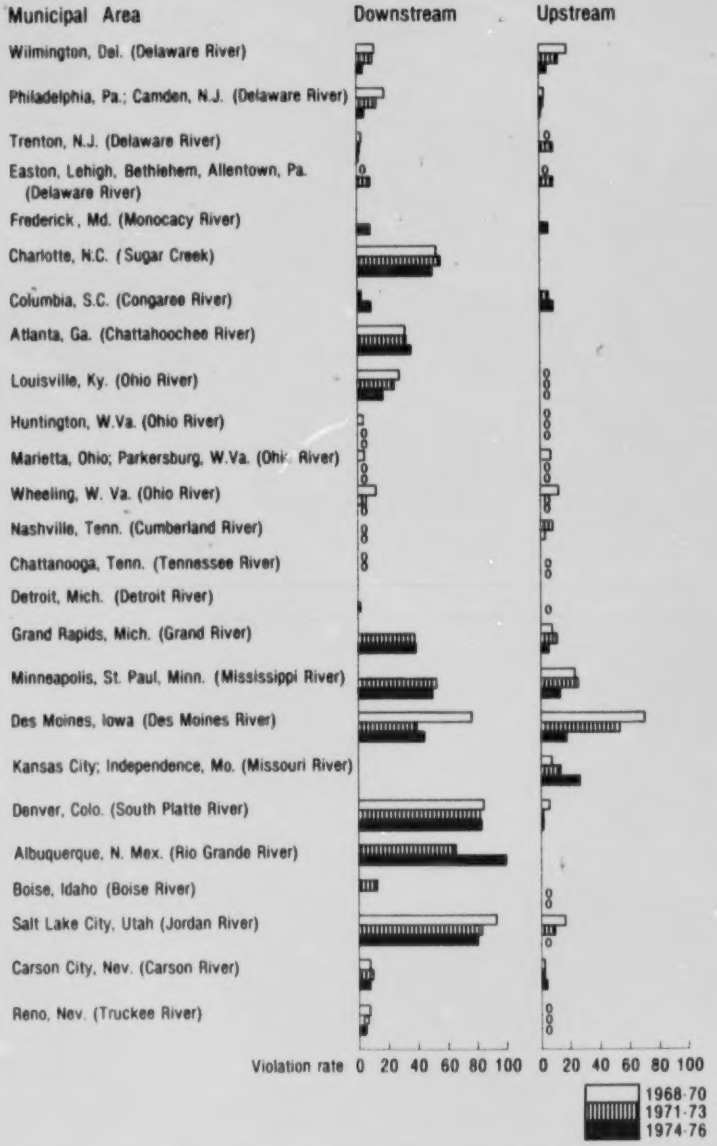
Dissolved Oxygen, Mean Violation Rates,[1] 1968–76



[1] Percentage of observations which fell below the benchmark level of 5.0 milligrams per liter.
Source: UPGRADE, based on EPA's STORET system data.

Figure 28

Biochemical Oxygen Demand, Mean Violation Rates,[1] 1968–76



[1] Percentage of observations which exceeded the benchmark level of 5.0 milligrams per liter.
Source: UPGRADE, based on EPA's STORET system data.

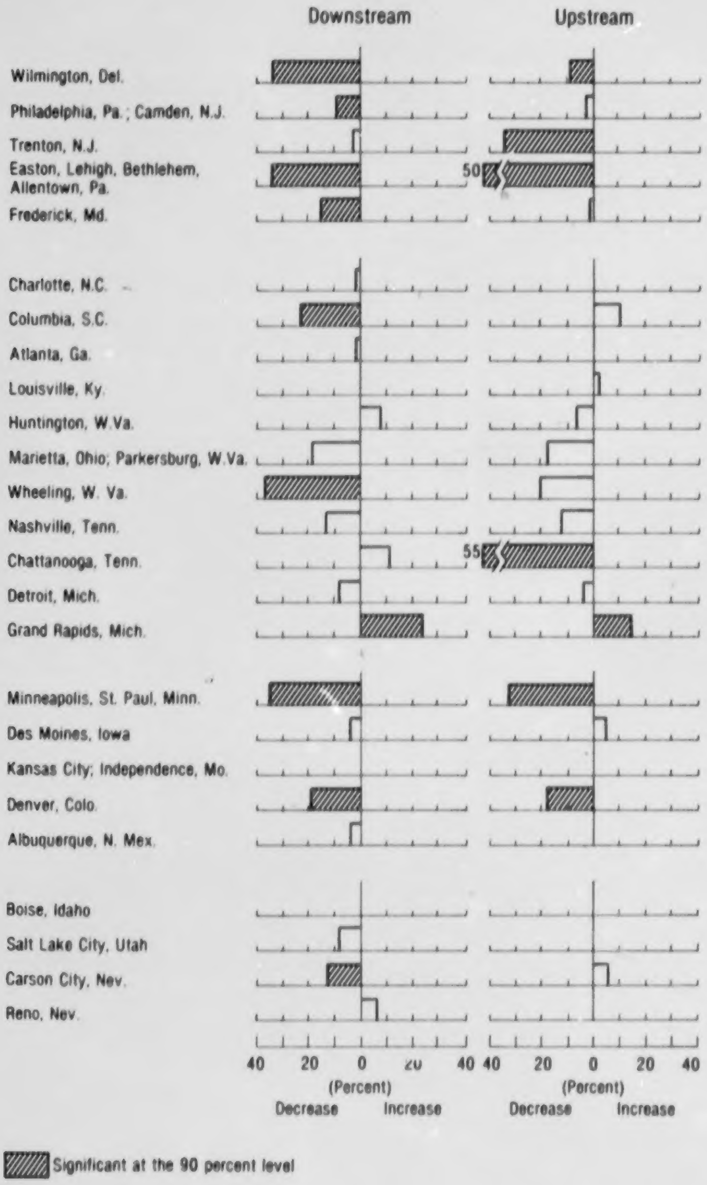


Figure 29

Fecal Coliform Bacteria, Change in Violation Rates, 1968–73 to 1974–76 study, and 4 of those showed improving trends. Only Kansas City had a worsening trend.

CEQ's benchmark level for biochemical oxygen demand, 5 milligrams per liter, was similarly exceeded in 10 percent or more of the measurements at only 8 of the study areas during any time period in the study (Figure 28). Three of these showed improvements over 1968–76, two showed degradation, and three no change.

Violations of all the sanitary water quality variables were generally at their worst, especially downstream of the cities, during the summer months of July, August, and September when streamflow rates are low (Table 5). Dissolved oxygen is naturally lower in warm water, so it is more susceptible to pollutant stress in the summer. Seasonal variations in fecal coliform bacteria and BOD were generally less pronounced.

Table 5

Average Violation Rates for All Reporting Study Areas, 1974–76

Variable	Upstream [1]			Downstream [1]		
	Summer [2]	Remaining 9 months	Difference	Summer [2]	Remaining 9 months	Difference
Fecal coliform bacteria	45	40	+5	67	59	+8
Dissolved oxygen	34	14	+20	32	12	+20
Biochemical oxygen demand	7	3	+4	33	36	−3

[1] Downstream rates were calculated on at least 2,100 individual measurements for each variable. Upstream rates were calculated on at least 1,100 measurements for each variable.

[2] July, August, and September.

Source: UPGRADE, based on EPA's STORET system data.

Sewage Treatment

As of January 1, 1976, only 58 percent of the total sewage flow in the 25 study areas was receiving a secondary level of treatment or better (Table 6). In 6 of the cities, less than 10 percent of the flow was getting secondary treatment, but 6 other cities were giving secondary treatment to more than 80 percent of their sewage. Approximately 17 percent of the 22.4 million residents of the study areas have no municipal sewage treatment service at all, and in 6 of the cities (Wilmington, Columbia, Louisville, Nashville, Grand Rapids, and Boise), less than 60 percent of the population receives municipal treatment services.

By 1990, all but one of the cities expect to be providing at least secondary sewage treatment to 85 percent or more of their residents, but great effort will be required to achieve this goal, and achieving it will depend upon availability of resources (see the water section in

Table 6

Sewage Treatment, 1976 Conditions and Growth Required To Meet 1990 Projections

Municipal area	Total sewage flow (MGD)[1]	Percent sewage flow receiving less than secondary treatment	Percent population receiving sewage treatment services		Percent increase in total sewage flow by 1990	Projected percent increase in population served by 1990
			1976	1990		
Wilmington, Del.	51.0	13	14	25	19	170
Philadelphia, Pa.	782.9	85	89	94	32	20
Trenton, N.J.	52.5	93	96	100	44	62
Easton, Pa.	62.1	75	86	97	48	49
Frederick, Md.	9.1	81	69	100	29	76
Charlotte, N.C.	55.5	8	95	100	27	51
Columbia, S.C.	31.9	99	54	100	111	212
Atlanta, Ga.	276.6	59	92	100	70	70
Louisville, Ky.	132.5	21	40	97	83	474
Huntington, W. Va.	34.3	93	63	95	55	69
Marietta, Ohio	11.2	99	75	100	78	73
Wheeling, W. Va.	37.1	99	79	100	22	46
Nashville, Tenn.	72.5	82	50	100	135	136
Chattanooga, Tenn.	145.3	91	64	100	45	57
Detroit, Mich.	1,164.0	2	80	97	29	44
Grand Rapids, Mich.	81.5	64	59	87	41	66
Minneapolis, Minn.	246.6	0	92	95	33	54
Des Moines, Iowa	40.7	89	93	100	58	16
Kansas City, Mo.	266.9	73	90	100	42	75
Denver, Colo.	375.9	39	100	100	32	52
Albuquerque, N. Mex.	61.1	36	84	100	42	60
Boise, Idaho	19.2	63	51	100	82	132
Salt Lake City, Utah	152.5	0	100	100	29	32
Carson City, Nev.	3.8	0	74	100	28	115
Reno, Nev.	24.0	83	80	100	64	95
All cities	4,190.7	42	83	96	40	53

[1] Million gallons per day.

Source: CEQ analysis of EPA data: 1974 and 1976 Needs Survey file, Grants Information and Control Systems, Project Register file, and the Contract Awards file.

Chapter 1). Capacities will have to be expanded on the average by 40 percent. The exception is Wilmington, which is presently treating the sewage of only 14 percent of its population and expects to increase this figure to no more than 25 percent by 1990.

Projections of need for increased treatment capacity are based largely on projected population increases but also on the extension of services to areas that now have none. By 1990, it is projected that the population receiving service in the 25 areas will increase by 53 percent and that 26.8 million of their 27.9 million residents will be served. This increase means that some 8.9 million people will be added to the 17.9 million now being served—about 5.3 million because of increased population and the other 3.6 million because of expansion of services.

The 1976 Needs Survey conducted by EPA, when adjusted to include the Federal Water Pollution Control Act (P.L. 92-500) grants awarded prior to the survey, indicates that it will cost about $8.9 billion (in 1976 dollars) by 1990 to build the treatment facilities and sewers needed to meet the Act's requirements in the 25 study areas—some $399 per capita (see Table 7). This investment, which qualifies for federal support under P.L. 92-500, is larger than the estimated replacement cost of all the sewage facilities now operating or under construction at the time (1972) of enactment of P.L. 92-500 in the 25 areas ($8.2 billion in 1976 dollars). Assuming that all the cities' "needs" are filled, 3 cities would have sewage systems that have a replacement value of more than $500 per capita. These are not the largest cities. They are Trenton, Carson City, and Reno.

Of the $8.9 billion in needs estimated in 1973, $7.7 billion remained on January 1, 1976, at the time of the latest Needs Survey. Of the remaining $7.7 billion, 42 percent was requested for treatment—much of it (35 percent) for new treatment facilities that include tertiary processes, and 58 percent was for sewer projects—26 percent for large interceptor sewers and 32 percent for other sewers eligible for federal funding (see Table 8).

Even before the federal government assumed the major financial burden of upgrading sewage treatment facilities under the Federal Water Pollution Control Act, federal contributions were considerable. In the 25 study areas, federal obligations predating P.L. 92-500 amounted to $97 million (Table 9). New obligations are substantially higher. Nationally, federal grants for eligible projects totaled $2 billion by the end of 1975, $11.2 billion by September 1976, and $18 billion by September 1977. The increase followed an enlarged definition of "eligible" projects and an increased maximum share paid by the federal government—from 55 percent of a project cost to 75 percent under P.L. 92-500.

Nearly all the sewage treatment facilities in operation to 1976 in the 25 areas were built without P.L. 92-500 funding because they were begun before it was available. Often it is 5 years or more from initial application for construction funds to full operation of a treatment

Table 7

Costs of Existing and Required Municipal Sewage Facilities upon Enactment of Public Law 92–500

(1976 dollars)

Municipal area	Cost of facilities required by 1990		Replacement value of 1973 facilities		Percent cost of 1976 required facilities to value of 1973 facilities
	Total (million dollars)	Per capita (dollars)	Total (million dollars)	Per capita (dollars)	
Wilmington, Del.	138	277	43	87	212
Philadelphia, Pa.	1,328	275	1,845	383	57
Trenton, N.J.	134	441	192	630	52
Easton, Pa.	146	246	192	323	76
Frederick, Md.	51	596	32	373	140
Charlotte, N.C.	113	202	73	130	154
Columbia, S.C.	98	302	42	131	212
Atlanta, Ga.	507	317	687	431	70
Louisville, Ky.	357	412	283	326	122
Huntington, W. Va.	164	571	35	123	406
Marietta, Ohio	75	523	70	483	107
Wheeling, W. Va.	125	683	74	404	169
Nashville, Tenn.	342	489	59	85	541
Chattanooga, Tenn.	138	373	110	296	103
Detroit, Mich.	2,321	523	1,826	412	108
Grand Rapids, Mich.	162	301	263	487	53
Minneapolis, Minn.	1,006	512	859	437	93
Des Moines, Iowa	108	344	114	362	94
Kansas City, Mo.	706	554	544	427	117
Denver, Colo.	554	447	405	327	123
Albuquerque, N. Mex.	39	117	74	222	51
Boise, Idaho	139	1,239	55	494	235
Salt Lake City, Utah	108	153	266	378	40
Carson City, Nev.	11	709	18	1,160	61
Reno, Nev.	71	590	67	555	98
All cities	8,936	399	8,228	368	94

Source: CEQ analysis of EPA data: 1974 and 1976 Needs Survey file, Grants Information and Control Systems, Project Register file, and the Contract Awards file.

Table 8

Remaining Municipal Sewage Facility Needs, 1976

Municipal area	Total 1976 needs (million dollars)	Percent of total needs required			
		Secondary sewage treatment facilities	Tertiary sewage treatment facilities	Interceptor sewer facilities	All sewer projects
Wilmington, Del.	92	1	51	40	49
Philadelphia, Pa.	1,053	2	70	18	29
Trenton, N.J.	99	17	57	10	26
Easton, Pa.	145	3	48	17	49
Frederick, Md.	44	0	42	33	58
Charlotte, N.C.	112	0	52	37	48
Columbia, S.C.	90	22	2	53	75
Atlanta, Ga.	481	0	59	29	41
Louisville, Ky.	345	3	31	34	65
Huntington, W. Va.	144	18	11	42	71
Marietta, Ohio	74	24	17	33	59
Wheeling, W. Va.	125	23	18	28	59
Nashville, Tenn.	321	1	36	21	63
Chattanooga, Tenn.	113	4	36	18	59
Detroit, Mich.	1,965	0	16	28	84
Grand Rapids, Mich.	140	0	27	29	73
Minneapolis, Minn.	800	0	46	28	54
Des Moines, Iowa	106	8	69	8	22
Kansas City, Mo.	636	41	4	45	55
Denver, Colo.	498	8	41	3	51
Albuquerque, N. Mex.	38	57	0	10	43
Boise, Idaho	130	6	26	39	68
Salt Lake City, Utah	106	0	81	4	19
Carson City, Nev.	11	0	49	25	51
Reno, Nev.	66	3	40	29	57
All cities	7,734	7	35	26	58

Source: CEQ analysis of EPA data: 1974 and 1976 Needs Survey file, Grants Information and Control Systems, Project Register file, and the Contract Awards file.

Table 9

Total and Per Capita Federal Funding for Approved Projects

Municipal area	Pre-P.L. 92-500		P.L. 92-500 to 2/77	
	Total [1]	Per capita [2]	Total [1]	Per capita [2]
Wilmington, Del.	22.12	44	35.5	71
Philadelphia, Pa.	14.74	3	238.2	49
Trenton, N.J.	1.25	4	46.8	154
Easton, Pa.	0.0	0	32.3	54
Frederick, Md.	2.49	29	6.3	74
Charlotte, N.C.	0.0	0	14.1	25
Columbia, S.C.	0.0	0	10.0	31
Atlanta, Ga.	0.0	0	54.2	34
Louisville, Ky.	2.21	3	51.1	59
Huntington, W. Va.	3.18	11	15.9	56
Marietta, Ohio	0.0	0	.6	4
Wheeling, W. Va.	1.37	8	1.1	6
Nashville, Tenn.	0.37	1	19.0	27
Chattanooga, Tenn.	1.07	3	22.4	60
Detroit, Mich.	0.0	0	270.2	61
Grand Rapids, Mich.	4.11	8	28.8	53
Minneapolis, Minn.	0.40	0	155.0	79
Des Moines, Iowa	0.0	0	1.7	5
Kansas City, Mo.	1.20	1	71.5	56
Denver, Colo.	26.21	21	50.4	41
Albuquerque, N. Mex.	14.38	43	2.9	9
Boise, Idaho	2.36	21	8.2	73
Salt Lake City, Utah	0.05	0	1.9	3
Carson City, Nev.	0.0	0	0.0	0
Reno, Nev.	0.0	0	4.0	33
All cities	97.49	4	1,142.0	51

[1] Million dollars.
[2] Current dollars.

Source: CEQ analysis of EPA data: 1974 and 1976 Needs Survey file, Grants Information and Control Systems, Project Register file, and the Contract Awards file.

facility. But now the massive federal funding provided by P.L. 92-500 has become a dominant factor in meeting the cities' needs.

P.L. 92-500 grants awarded through 1975 equaled 12 percent of the estimated needs as of 1973 for the 25 areas. Additional grants awarded through January 1977 accounted for an additional 4 percent of needs (Table 10). As of February 1977, 5 cities had met less than 5 percent of their needs: Marietta, Wheeling, Des Moines, Salt Lake City, and Carson City.

Medium- and large-sized communities have done well under P.L. 92-500, as Tables 10 and 11 show. The 6 smallest cities represented only 5 percent of the total 1973 needs, and through January 1977 they had received only 2 percent of the grants; the medium-sized cities (200,000-500,000) with 16 percent of the estimated needs received 21 percent of the grants. Table 11 shows in another way how the medium-sized and large cities fared better than the small cities in

Table 10

Eligible Costs as a Percent of 1973 Needs

Municipal area	Size[1]	Pre-1/76 grants	1/76 to 2/77 grants
Wilmington, Del.	M	34	0
Philadelphia, Pa.	L	20	4
Trenton, N.J.	M	26	19
Easton, Pa.	M	0	29
Frederick, Md.	S	13	4
Charlotte, N.C.	M	1	16
Columbia, S.C.	M	8	6
Atlanta, Ga.	L	5	9
Louisville, Ky.	M	3	16
Huntington, W. Va.	M	12	1
Marietta, Ohio	S	1	1
Wheeling, W. Va.	S	0	1
Nashville, Tenn.	L	6	1
Chattanooga, Tenn.	M	18	4
Detroit, Mich.	L	15	1
Grand Rapids, Mich.	L	14	10
Minneapolis, Minn.	L	11	10
Des Moines, Iowa	M	1	1
Kansas City, Mo.	L	10	3
Denver, Colo.	L	10	2
Albuquerque, N. Mex.	M	4	6
Boise, Idaho	S	6	2
Salt Lake City, Utah	L	2	0
Carson City, Nev.	S	0	0
Reno, Nev.	S	7	1
Average			
Small		5	1
Medium		11	11
Large		12	4
All cities		12	4

[1] L =Large cities (>500,000).
M=Medium cities (200,000-500,000).
S =Small cities (<200,000).

Source: CEQ analysis of EPA data: 1974 and 1976 Needs Survey file, Grants Information and Control Systems, Project Register file, and the Contract Awards file.

meeting their stated needs, obtaining grants for 22 and 16 percent of their requests, respectively, compared to 6 percent for the small cities.

A full assessment of the construction grants program is not yet possible, but enough information is available for some insights. We categorized cities in our study as having "high needs" if they met any of three somewhat arbitrary criteria. Similarly, two other measures were used to designate "high federal aid" cities. The three "high needs" measures were: 90 percent or more of the 1976 sewage flow received less than secondary treatment; the 1976 sewage flow was projected to increase more than 70 percent by 1990; and stated needs for new facilities cost more than twice the replacement of existing facilities. Of course, these measures are not independent of each other because expressed needs reflect requirements for increasing

Table 11

Comparison of Cities by Size, 1976

	Small		Medium		Large		All cities
	Value	Percent of total	Value	Percent of total	Value	Percent of total	
Cities	6	24	10	40	9	36	25
1970 Population (millions)	0.7	3	4.4	20	17.3	77	22.4
1973 Replacement value (million dollars)	316	4	1,157	14	6,754	82	8,228
Per capita (dollars)	451		260		390		368
1973 Needs (million dollars)	472	5	1,434	16	7,030	79	8,936
Per capita (dollars)	715		322		406		399
P.L. 92-500 grants to 1976 [1] (million dollars)	24	2	158	16	879	83	1,061
Grants as a percent of needs	5		11		12		12
P.L. 92-500 grants to 2/77 [1] (million dollars)	27	2	313	21	1,132	77	1,472
Grants as a percent of needs	6		22		16		16
1976 Population served (millions)	0.7	3	3.4	16	17.6	81	21.6
Percent of population connected to facilities	71		67		84		81
1990 Population served (millions)	0.9	3	5.1	18	22	79	28
Percent of population connected to facilities	100		90		97		96
1976 Flow (million gallons per day)	104	2	667	16	3,420	82	4,190
1990 Flow (million gallons per day)	156	3	1,024	17	4,689	80	5,869
Percent flow receiving less than secondary treatment	84		58		38		40

[1] Eligible costs for approved grants.

Source: CEQ analysis of EPA data: 1974 and 1976 Needs Survey file, Grants Information and Control Systems, Project Register file, and the Contract Awards file.

treatment levels and projections of increased flow. The "high federal aid" measures were: P.L. 92-500 funding through 1977 was 20 percent or more of 1973 needs, and funding for 1976 was 15 percent or more of 1973 needs (see Table 12).

As Table 12 shows, 10 of the 25 cities meet one or more criteria for high needs cities and 9 meet at least one of the criteria for high aid. Four cities are both high need and high aid cities: Wilmington, Trenton, Louisville, and Chattanooga. The one that meets all three criteria for high needs—Columbia, South Carolina—does not receive high federal aid by either measure. Further, none of the four cities that meet two criteria for high needs is receiving high federal aid.

Table 13 gives a further rough indication of how well the grants program has been meeting municipal needs. The nine cities in the "high aid" list—with 47 percent of the population and 40 percent of the needs—have been given 55 percent of the grants. On the other

Table 12

Cities Meeting High Needs and High Aid Criteria[1]

	High needs			High aid	
	1	2	3	1	2
Wilmington, Del.			●	●	
Philadelphia, Pa.				●	
Trenton, N.J.	●			●	●
Easton, Pa.				●	●
Frederick, Md.					
Charlotte, N.C.					●
Columbia, S.C.	●	●	●		
Atlanta, Ga.					
Louisville, Ky.		●			●
Huntington, W. Va.	●		●		
Marietta, Ohio	●	●			
Wheeling, W. Va.	●				
Nashville, Tenn.		●	●		
Chattanooga, Tenn.	●			●	
Detroit, Mich.					
Grand Rapids, Mich.				●	
Minneapolis, Minn.				●	
Des Moines, Iowa					
Kansas City, Mo.					
Denver, Colo.					
Albuquerque, N. Mex.					
Boise, Idaho		●	●		
Salt Lake City, Utah					
Carson City, Nev.					
Reno, Nev.					

[1] High needs
1. Ninety percent or more of 1976 sewage flow receiving less than secondary treatment.
2. Flow expansion of more than 70 percent required by 1990.
3. Needs in 1990 greater than twice the value of 1973 facilities.

High aid
1. P.L. 92-500 funds awarded to 2/77 were 20 percent or more of 1973 needs.
2. P.L. 92-500 funds awarded 1/76 to 2/77 were 15 percent or more of 1973 needs.

Source: CEQ analysis of EPA data: 1974 and 1976 Needs Survey file, Grants Information and Control Systems, Project Register file, and the Contract Awards file.

Table 13

Selected Measures of Grants Program By City Category

(percent)

	High needs [1]	High aid [2]	Neither [3]	Both [4]
Number of cities	40	36	40	16
1970 Population	17	47	45	9
1976 Flow	14	38	57	9
Replacement value	12	47	49	8
Needs	20	40	50	9
P.L. 92-500 grants	19	55	41	14

[1] 10 cities.

[2] 9 cities.

[3] 10 cities.

[4] 4 cities.

Source: CEQ analysis of EPA data: 1974 and 1976 Needs Survey file, Grants Information and Control Systems, Project Register file, and the Contract Awards file.

hand, the "high needs" cities—with 17 percent of the population and 29 percent of the estimated dollar needs—do not seem to be receiving special consideration. They have received 19 percent of the funds.

Most cities on the high needs list are small or medium sized, with less than 500,000 population. The one large city with high needs—Nashville—is not receiving high aid, and the three large cities—Philadelphia, Grand Rapids, and Minneapolis—on the high aid list do not meet the measures for high needs. The absence of large cities on the high needs list is not surprising because they generally give adequate treatment to more of their sewage, expect less growth, and have a larger capital base already in place.

Conclusions

It is difficult to draw conclusions on the effects of the P.L. 92-500 grants program partly because the program is relatively new and partly because the data on grants, facilities, water quality, and related factors are scattered and often incompatible. Further, responsibilities within EPA for collecting and analyzing information on sewage treatment and sanitary water quality are fragmented. Yet only by pulling together data on the nation's urban areas can we analyze this enormous federal undertaking on a nationwide basis. This CEQ-EPA study attempted to begin such an evaluation, focusing on domestic wastes in 25 municipal areas, and a few general conclusions may be drawn:

- Sanitary water quality has significantly improved in most of the municipal study areas in the past 9 years, largely because of actions taken prior to enactment of P.L. 92-500. Severe pollution is still prevalent, with water quality criteria for bacterial levels being violated more often than not downstream of the cities. Improvements are expected once P.L. 92-500 projects are completed.

- The cities have a long way to go to meet P.L. 92-500 requirements. They did not meet the 1977 deadline for secondary treatment of sewage because 42 percent of the sewage was still receiving less than secondary treatment in 1976. Facilities would need to be expanded 40 percent by 1990 to meet the needs of a growing population and upgrade plants to a secondary treatment level.
- A relatively small percentage of P.L. 92-500 grants has been awarded to smaller communities, many of which have few facilities already in place and need help in upgrading to meet secondary treatment requirements and to serve additional population.
- Cities with high needs do not seem to receive special consideration in awards of federal grants. The high aid cities have 47 percent of the population and 40 percent of the needs and have received 55 percent of the grants. On the other hand, high needs cities account for 17 percent of the population and 20 percent of the needs; they have received 19 percent of the grant awards. Moreover, cities with high dollar needs per capita (which may have difficulty obtaining funds for their local shares), often did not receive high aid. Thus the present mechanism for allocating grant funds does not always provide federal funding on a priority basis to cities which appear to merit it. Under current procedures, only cities that have taken significant initiatives are likely to draw federal funding.
- Much new construction will be required to serve a larger proportion of the population with adequate sewage treatment. Of the 10.4 million additional people to be served by 1990 (in accordance with the 1976 Needs Survey), 5.3 million, or 51 percent of the increased service, is due to raising the share of population served from 81 percent to 96 percent. The smaller communities plan to have 100 percent of their population connected to centralized sewage treatment facilities by 1990. Larger cities plan to serve 97 percent in 1990, compared with 84 percent today.

OIL AND TOXIC POLLUTANTS

Evidence of contamination of the nation's waters by oil and toxic substances is growing. The toxic substances include pesticides such as DDT, aldrin, dieldrin, chlordane, and heptachlor; other chemicals such as phenols, polychlorinated biphenyls (PCB's) and thousands of trace organic compounds; and heavy metals such as cadmium, lead, mercury, and zinc. Although historic data for most of them are not extensive, recent reports of significant levels of toxic substances in U.S. waters have been disturbingly consistent.

Toxic pollutants will probably pose the nation's most important water pollution problems in the future. Many are known to cause cancer and other serious health problems in humans. They can also cause death, reproductive failure, and other damage to fish and wildlife. Many of these substances persist in the environment at significant levels for years and accumulate in bottom sediments and the food web.

Oil Pollution

Few pollution incidents draw as much public attention and concern as large oil spills. The past decade has witnessed the *Torrey Canyon*, Santa Barbara, *Argo Merchant*, many other spills, and the resulting damage to coastal and marine resources. Although some of the long-term effects of oil pollution remain the subject of scientific debate, there has never been any doubt that a major coastal spill is an esthetic and economic disaster. Oil slicks, oil-covered beaches, and dead birds are an unfortunately familiar sight to many who live in coastal areas.

The Council has conducted two recent studies to develop information on accidental oil spills. Spills from all sources since 1972 were analyzed in collaboration with EPA, which has regulatory responsibility for all inland spills as well as for all coastal spills that are not transportation related.[39] We also evaluated major spills from vessels from 1969 to early 1977 with the assistance of the Coast Guard, which bears responsibility for the prevention of transportation-related coastal spills.[40]

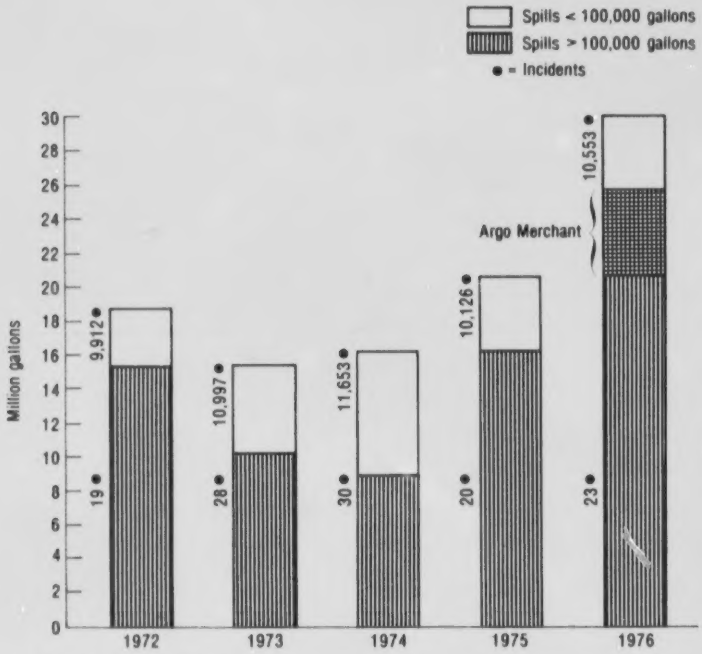
The first study determined that more than 10,000 oil spills occur each year in the nation's coastal and inland waters. However, year by year, roughly 80 percent of the total volume of oil spilled comes from the 20 to 30 largest spills—those larger than 100,000 gallons (Figure 30). Transportation by tankers, barges, and other vessels is by far the largest single source of oil spills, in both number of incidents and total volume, shown in Figure 31. Spills from pipelines and onshore wells rank second and third. Compared with other sources, oil is spilled from vessels in U.S. waters at a relatively high rate per volume of oil handled. The largest vessel-related spills are primarily responsible for this relatively high rate.

As a followup, CEQ conducted the second study to determine the patterns of occurrence of 131 large vessel-related oil spills recorded from 1969 through early 1977. Each year between 10 and 25 spills occurred, and nearly all were from ocean-going tankers and inland or coastal barges. Barge capacity rarely exceeds 1 million gallons, but tanker sizes vary considerably. The *Argo Merchant* was a medium-sized tanker with a capacity of 7.7 million gallons.

The study did not show that the heavily publicized spills of the 1976–77 autumn and winter represented a worsening trend in large vessel-related spills taking place within 200 miles of U.S. coastlines. Ten large incidents occurred during this time, 3 involving tankers

Figure 30

U.S. Oil Spillage by Volume, 1972–76[1]



[1]Within 200 miles of U.S. coasts.

Source: GKY and Associates, Inc., *Analysis of Oil Spill Trends*, prepared for the Council on Environmental Quality and the U.S. Environmental Protection Agency under Contract No. EQ6AC014 (Springfield, Va.: National Technical Information Service, 1976), based on U.S. Coast Guard data, p. 22.

and 7 barges; they spilled a total of 10.5 million gallons. Their chronology is shown below:

- October 5, 1976, *Sealift Pacific*, tanker, Cook Inlet, Alaska, aground, 1,260,000 gallons
- October 29, 1976, *Richard C. Sauer*, tanker, Perth Amboy, N.J., aground, 276,300 gallons
- November 30, 1976, *Elk River*, barge, Potomac River, Quantico, Va., aground, 200,000 gallons
- December 16, 1976, *Argo Merchant*, tanker, Nantucket, Mass., aground, 7,670,000 gallons
- December 26, 1976, *T/B Peck Slip*, barge, near Puerto Rico, leaking while underway, 348,600 gallons
- December 27, 1976, *Olympic Games*, tanker, Delaware River near Marcus Hook, aground, 133,000 gallons

Figure 31

U.S. Oil Spills 1975
Volume

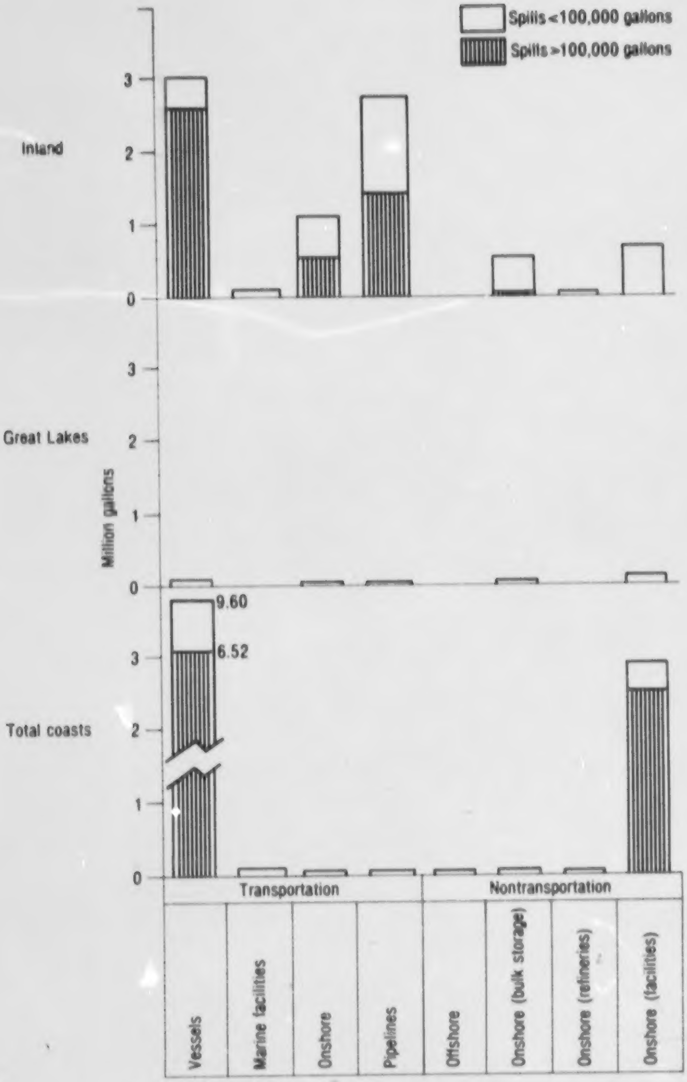


Figure 31 (continued)

As a Percent of Oil Transported

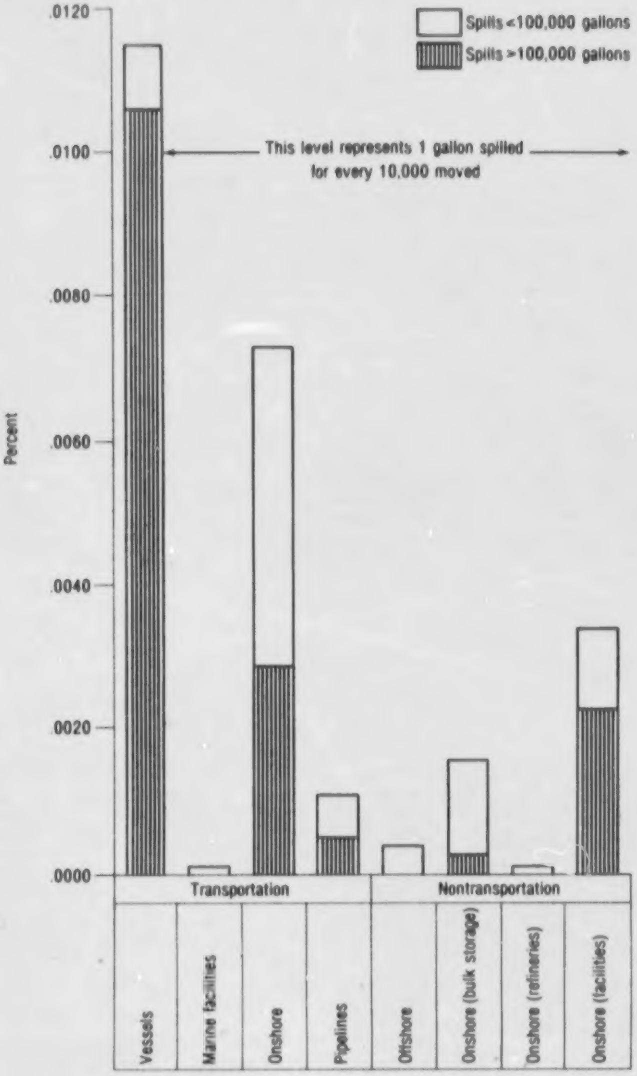
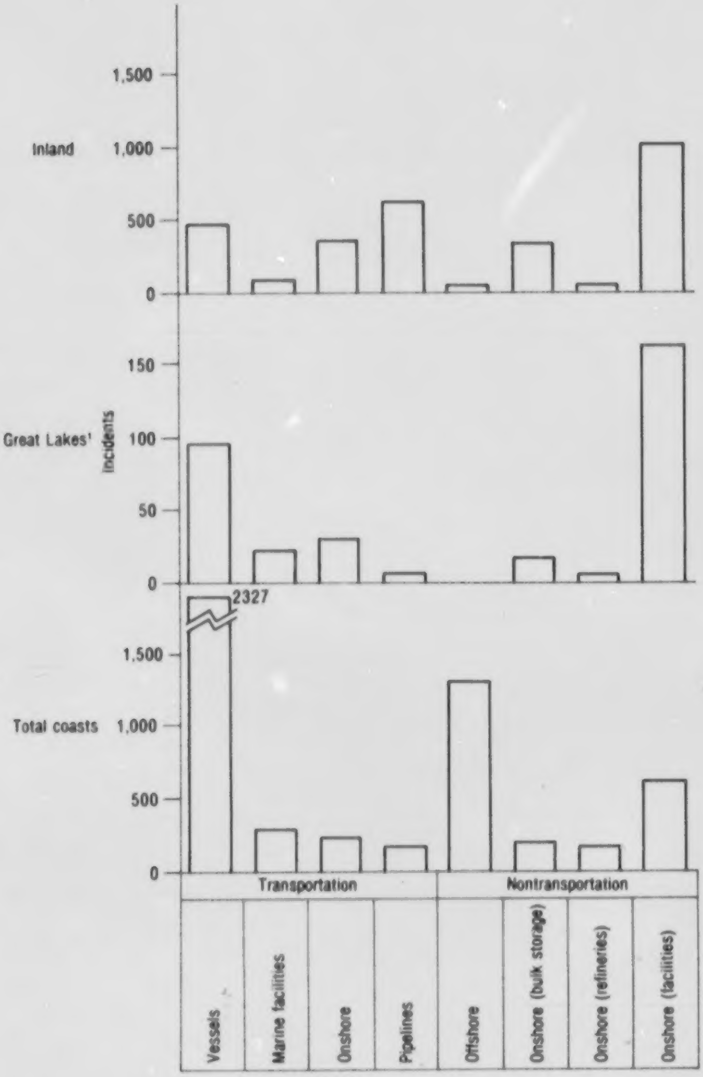


Figure 31 (continued)

Incidents



¹Great Lakes plotted on a larger scale.

Source: GKY and Associates, Inc., *Analysis of Oil Spill Trends*, prepared for the Council on Environmental Quality and the U.S. Environmental Protection Agency under Contract No. EQ6AC014 (Springfield, Va.: National Technical Information Service, 1976), based on U.S. Coast Guard data.

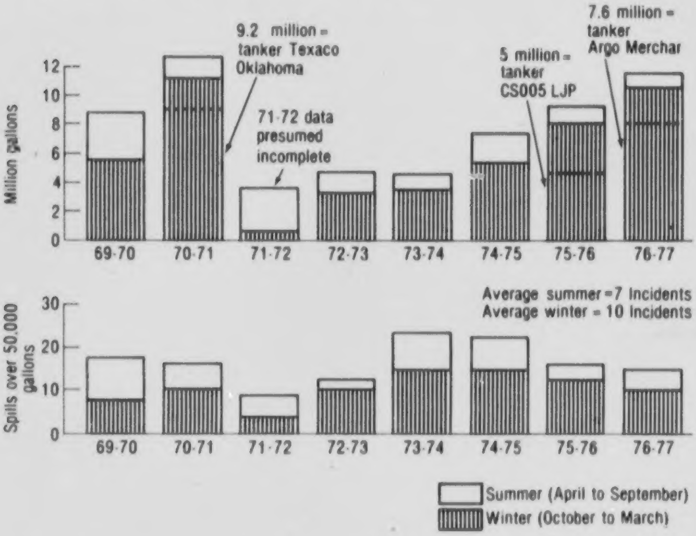
- January 9, 1977, *T/B New York,* tanker, Tampa Harbor, Fla., collision, 54,000 gallons
- January 21, 1977, *NMS 2600*, barge, Mississippi River near Norco, La., collision, 62,000 gallons
- January 28, 1977, *Frederick Bouchard*, barge, Buzzard's Bay, Mass., aground, 100,000 gallons
- February 4, 1977, *Ethel H*, barge, Hudson River near West Point, aground, 420,000 gallons.[41]

Figure 32 summarizes the data on large vessel-related spills since 1969 by season—the number of incidents and the volume of oil spilled. Although the total volume spilled was greater in 1976–77 than in any other year except 1970–71, more than one-half of the 1976–77 total was from the *Argo Merchant*. This year was similar to 1970–71, when the tanker *Texaco Oklahoma* accounted for about 75 percent of the oil spilled in large incidents. Were it not for the *Argo Merchant*, 1976–77 may have been the best year of the decade. In terms of the total number of incidents, 1976–77 was not an unusual year.

Analysis of recent occurrences provides several insights. First, there is a distinct seasonal difference: significantly more large incidents occur regularly in autumn and winter than in spring and summer

Figure 32

Major U.S. Oil Spills from Vessels, 1969–77



Source: GKY and Associates, Inc., *Major Oil Spills from Tankers and Barges and Other Vessels in U.S. Waters —Analysis of Recent Trends and Patterns*, prepared for the Council on Environmental Quality under Contract No. EQ7AD239 (Springfield, Va.: National Technical Information Service, 1977), p. 4.

(Figures 32 and 33). Second, in 3 of the 4 years for which we have complete data, collisions caused more spills and more oil spilled than groundings; the *Argo Merchant* grounding reversed the relationship in 1976–77 (Figure 34). Unloading accidents, breaking at sea, and other causes of vessel spills were not major factors in the past 4 years except for one incident in 1975–76 when an open tanker valve caused a 5-million gallon spill. Third, the number of large spills from barges increased as a percentage of spills from all vessels (Figure 34). The volume of barge spills is dwarfed by the major tanker spills, but barge spills tend to occur nearer shore and in inland waters where their potential impact is great. Further, more than one-half the major spill incidents occurred along the Atlantic coast and in inland waters (Figure 34). Atlantic coastal navigation often involves shallow waters, shoaling, and adverse weather in the winter months.

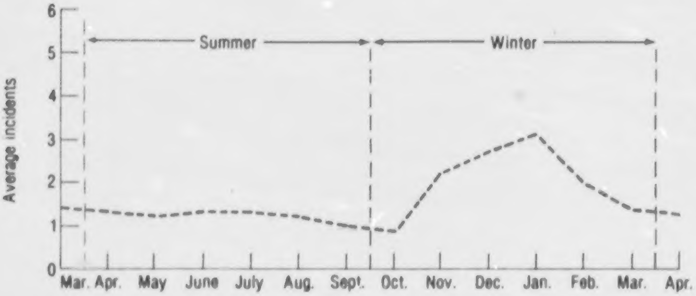
Pesticides

It is 15 years since publication of Rachel Carson's *Silent Spring*[42] and 5 years since EPA's ban on DDT—the first major pesticide ban—went into effect. During this period, aquatic contamination by pesticides has been extensively studied and regulated. Residues of some pesticides have declined significantly in some areas; others persist and even increase. In 1976, 18 states listed pesticide contamination among the major water pollution problems which they reported to EPA (Table 14).

Pesticide residues enter waterways from point sources or as runoff from diffuse land areas. Point sources, such as spillage at a production plant, can affect a small area in a short time. However, nonpoint

Figure 33

Monthly Distribution of Major U.S. Oil Spills from Vessels, 1973–75



Source: GKY and Associates, Inc., *Major Oil Spills from Tankers and Barges and Other Vessels in U.S. Waters—Analysis of Recent Trends and Patterns*, prepared for the Council on Environmental Quality under Contract No. EQ7AD239 (Springfield, Va.: National Technical Information Service, 1977), p. 14.

Table 14

Toxic Pollutant Problems in Reporting States, 1976

	Heavy metals	Pesticides	Phenols	Cyanide	PCB's
Alabama		●			
Alaska					
Arizona	●				
Arkansas	●	●			
California	●	●			
Colorado	●				
Connecticut	●	●			●
Delaware	●		●		
Florida	●				
Hawaii	●				
Idaho	●	●			
Illinois	●	●	●	●	●
Indiana	●		●	●	●
Kansas					
Kentucky	●				
Maine	●	●	●		
Maryland	●				
Massachusetts	●	●			●
Michigan	●	●	●		●
Minnesota	●		●		●
Mississippi	●	●			
Missouri	●				
Montana	●	●			
Nevada	●			●	
New Hampshire		●			
New Mexico	●				
New York	●	●	●		●
North Carolina	●		●		
Ohio	●	●	●	●	
Oklahoma	●			●	
Pennsylvania	●				
South Carolina	●				
Tennessee	●	●	●	●	
Texas	●	●			
Utah	●				
Vermont					
Virginia	●	●			
Washington					
West Virginia	●		●		
Wisconsin	●	●			●
Wyoming	●				

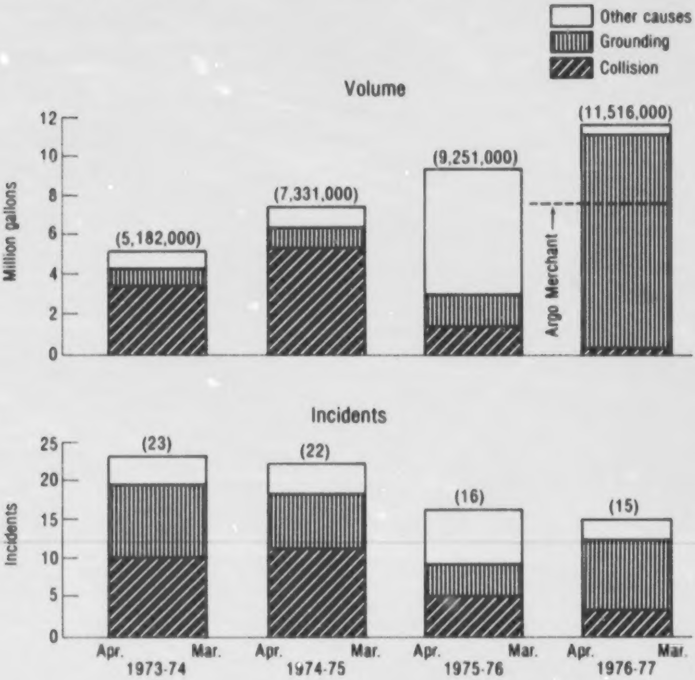
Source: Environmental Protection Agency, ***National Water Quality Inventory: 1976 Report to Congress*** (Washington, D.C.: Government Printing Office, 1977), EPA-440/9-76-024, p. 12.

sources are much more widespread and are responsible for most of the nation's pesticide pollution problems. These sources are primarily agricultural land runoff and irrigation return flows, but urban and residential areas also contribute significantly.

Approximately 1 billion pounds of synthetic organic pesticides are used in the United States each year.[43] If this quantity were blanketed

Figure 34

Causes of Major U.S. Oil Spills from Vessels, 1973–77

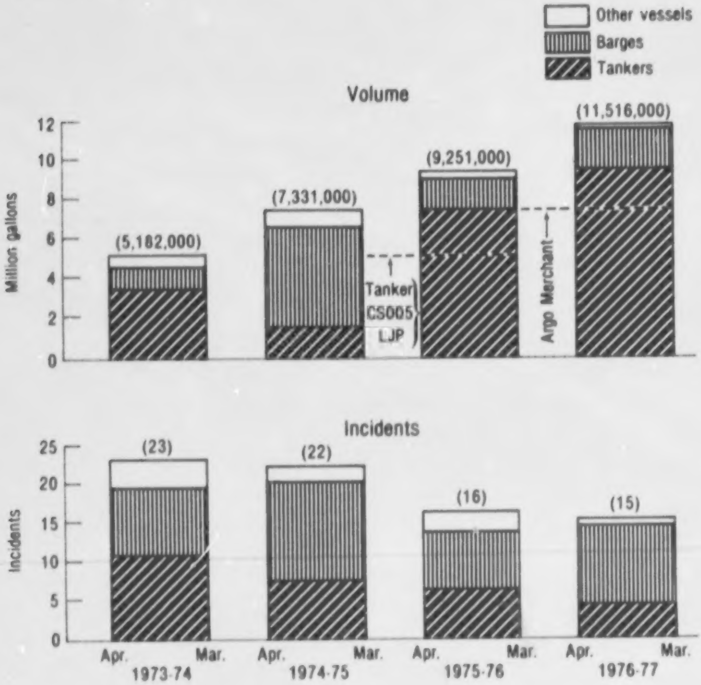


uniformly over the entire U.S. land area (3.6 million square miles), about 275 pounds of active pesticide ingredient would be deposited on each square mile of land each year.[44] Of course, pesticide application is unevenly distributed with respect to the chemical compounds and formulations used, the type of uses, and geographical location. For example, although roughly 60 percent of the annual use of synthetic organic pesticides is for agriculture, only about 6 percent of all cropland, including pastures, is treated with insecticides, 17 percent with herbicides, and 0.8 percent with fungicides and nematocides.[45] Nearly one-half the insecticide use on row crops is for cotton, and about 44 percent of all herbicide use on row crops is for corn.

Between 1972 and 1975, EPA cancelled the sale and prohibited most uses of the persistent insecticides DDT, aldrin, dieldrin, chlordane, and heptachlor, as shown in Table 15. To determine how the ban of these chemicals and trends in pesticide use affect aquatic contamination, CEQ studied pesticide residues in the water and sediments of streams and other water bodies in Texas, Louisiana, and Oklahoma.

Figure 34 (continued)

Vessels Involved



The study area was chosen on the basis of a history of heavy pesticide usage and availability of adequate stream monitoring data. The area included parts of two Department of Agriculture Farm Production Regions—the Delta States and Southern Plains Region—

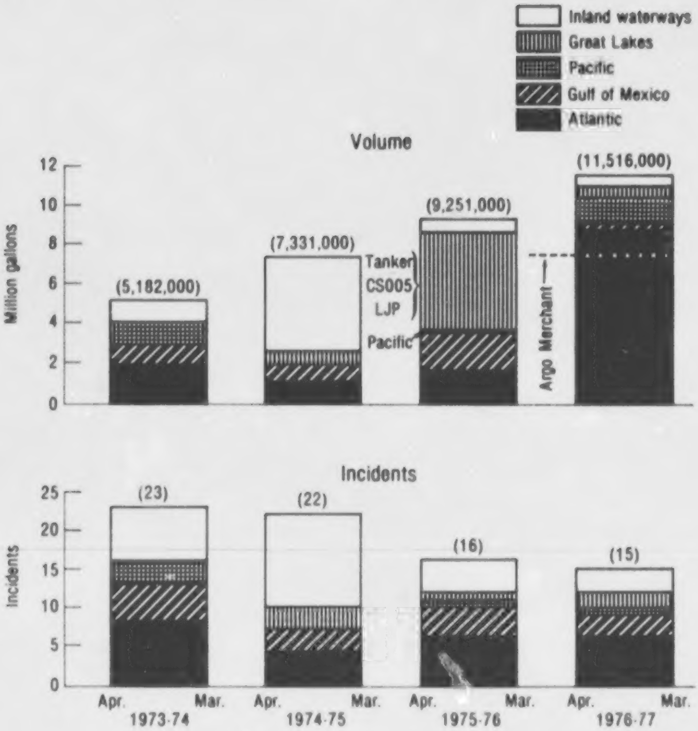
Table 15

Regulatory Action Taken by EPA with Certain Insecticides

Insecticide	Date	Action
DDT	1972	Most uses banned. Sales of DDT now prohibited.
Aldrin/dieldrin	1973	Dieldrin greatly restricted in 1973.
	1974	Registration suspended. Both substances still approved for termite control and certain minor uses involving no effluent.
Chlordane/heptachlor	1975	Registration suspended. A few specific uses still permitted pending completion of hearings now in session.

Figure 34 (continued)

Location



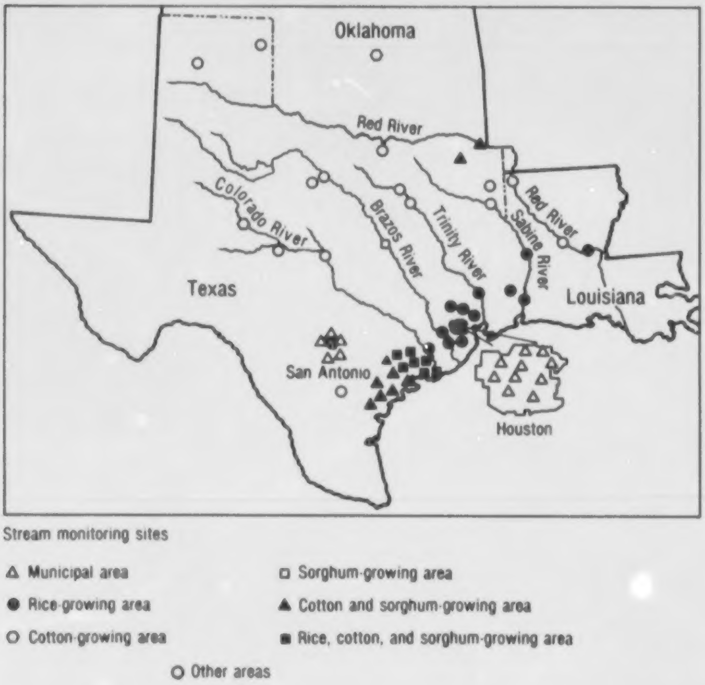
Source: GKY and Associates, Inc., *Major Oil Spills from Tankers and Barges and Other Vessels in U.S. Waters—Analysis of Recent Trends and Patterns*, prepared for the Council on Environmental Quality under Contract No. EQ7AD239 (Springfield, Va.: National Technical Information Service, 1977).

which account for about one-third of the nation's insecticide use on crops. Use of herbicides and other chemical pesticides is also high in the study area.[46] Although pesticide usage in the urbanized parts of this area is not documented as well, the available survey data indicate that large quantities of pesticides are also being used by homeowners and commercial firms in the cities and towns of the study area.[47] Sixty stream monitoring stations operated by the U.S. Geological Survey in cooperation with state agencies provided data for the study (Figure 35).

Figures 36 through 39 show the composite rates at which widely used pesticides were detected in water and sediment samples from 1968 to 1976. The data are aggregated according to major urban and agricultural crop areas. They show that widespread pollution

Figure 35

U.S. Geological Survey Stream Monitoring Sites Used in the CEQ Pesticide Study


Oklahoma
Red River
Colorado River
Brazos River
Trinity River
Sabine River
Red River
Texas
Louisiana
San Antonio
Houston
Stream monitoring sites
△ Municipal area
● Rice-growing area
○ Cotton-growing area
□ Sorghum-growing area
▲ Cotton and sorghum-growing area
■ Rice, cotton, and sorghum-growing area
○ Other areas

of streams in this southern region remains a substantial problem. The residues detected most frequently were the insecticides DDT (and its relatives DDD and DDE), chlordane, dieldrin, diazinon, and the herbicides 2,4-D and 2,4,5-T.

The most significant finding of the study was the prevalence in water samples—and even more so in stream sediment samples—of several pesticides that had been cancelled or restricted. For example, although sale of dieldrin was restricted in 1973 and its major uses suspended in 1974 because of its carcinogenic properties, dieldrin residues were often detected in 1976 (Figure 37). Dieldrin was detected in 21 percent of all water samples taken during 1976 in the three-state study area, and the detection rate for the Houston area was 68 percent. These high rates of detection leave open the possibility that the chemicals are still being used in residential areas, although a more likely explanation is that the sediments in some shallow bayous contain residual contamination that affects the water column measurements.

It is evident from Figures 36 and 37 that chlorinated hydrocarbon insecticide residues are much more widespread and persist much longer in sediments than in the water. For example, although water samples showed a considerable reduction in DDT residues for all three crop areas over the 9-year period and although no residues were detectable by the 1975 and 1976 samplings, sediment samples from the same streams still contain substantial levels of DDT and its relatives (Figure 36). This fact clearly shows the importance of sediment sampling to accurate assessment of pesticide contamination.

The trends indicate that aquatic contamination generally corresponds to the local use and known persistence properties of each pesticide. That diazinon, for example, is more frequently detected in the water bodies near the two metropolitan areas than in the agricultural regions where rice, cotton, or sorghum are grown (Figure 38) is not surprising because diazinon is widely used by urban and suburban homeowners but is limited for agricultural crops.

Figures 36 and 37 indicate that pollution by chlorinated hydrocarbon insecticides has declined in recent years. Similar trends would likely be found in similar analyses of other regions of the United States because domestic uses of these toxins has diminished. Nevertheless, it is apparent that persistent pesticides still constitute an important source of contamination of the nation's water.

Other Toxic Pollutants

Heavy metals and thousands of hazardous organic chemicals are also on the ever lengthening list of toxic water pollutants. They are known to be dangerous to health and aquatic life, but knowledge about most of their sources, levels, and effects is limited.

Toxic metal pollution was cited by 35 of the 41 states that reported water quality problems to EPA in 1976 (Table 14). In the heavily populated regions, especially east of the Mississippi, industrial discharges and urban storm water runoff are major sources. Mining, soil erosion, sewage effluents, and the atmospheric fallout of air pollutants also contribute major amounts. Natural geological sources of arsenic, lead, and other metals are significant in Montana, Wyoming, and other western states.

Acid drainage from active and abandoned mines is most significant in the Appalachian and western states, particularly Arizona, California, Colorado, Idaho, Nevada, and South Dakota. Sulfuric acid is formed when mining operations in both surface and underground mines expose sulfur-bearing rock to air and water. The acid drains into nearby streams, causing direct damage to aquatic life and also causing harmful secondary effects such as increasing the levels of toxic metals in solution.

The problems can be severe. Pennsylvania, for example, reports that abandoned mine drainage, by itself or with other pollution sources, is responsible for 75 percent of the state's nearly 3,000 presently degraded stream miles. The problems had been far worse. The large and profitable 19th-century fishery of the Monongahela River was destroyed by acid mine pollution in the upper river and industrial pollution near Pittsburgh. Although the lower river is still degraded by discharges from steel plants, fish populations in the upper Monongahela have been recovering during the past decade as a result of state requirements for treatment of acid mine wastes.

Polychlorinated biphenyls are among the multitude of newly recognized toxic organic water pollutants. PCB's have been used for years in various industrial applications, particularly as a dielectric fluid in electrical capacitors and transformers. Their hazard to human health became evident in 1968, when 1,000 Japanese were severely affected after ingesting PCB-contaminated rice oil. Japan has banned all manufacture and importation of PCB's as well as most uses.

PCB's are extremely persistent in water. Their degradation time is measured in decades. Although use is greatly restricted in the United States, millions of pounds have already been released into the environment. PCB residues exceeding the FDA tolerance level are being found in fish tissues from three of the Great Lakes, and eight states presently regard PCB contamination as one of their most important water pollution problems. It will take many years for the present levels in fish tissues and bottom sediments to drop substantially.

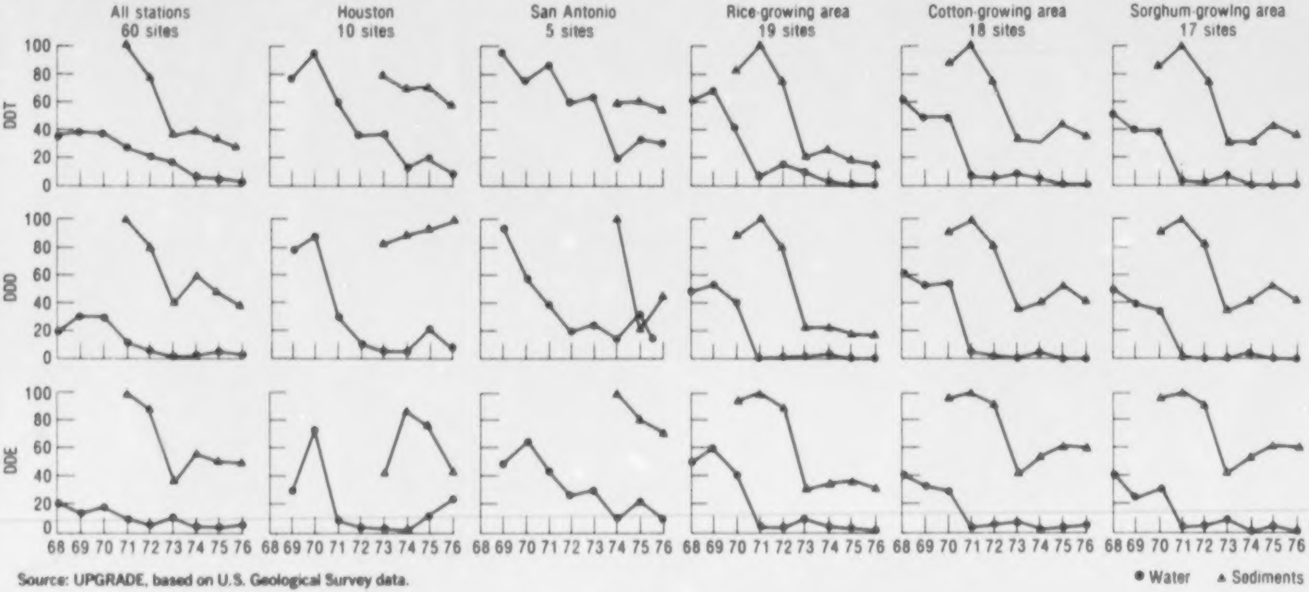
Recent studies have shown the presence of hundreds of other organic compounds in public drinking water supplies, as discussed in the environmental health section of this chapter. Many of these compounds are chlorinated hydrocarbons that are known or suspected to cause cancer, but information on their ambient levels, sources, and effects is scarce.

A few of the organic industrial chemicals have been recognized as water pollutants for some time, so available trend data for them are more extensive. Phenols and cyanide are examples. Control of water pollution from industries has reduced levels of these pollutants in waters of New York, Indiana, and other industrial states of the Northeast and Great Lakes region, but 13 states still considered them important water quality problems in 1976.

Phenols are a group of organic chemical pollutants that enter waterways from a variety of industries, sewage treatment plants, land runoff, and natural sources such as decaying vegetation. In some heavily industrialized areas, phenolic compounds are considered

Figure 36

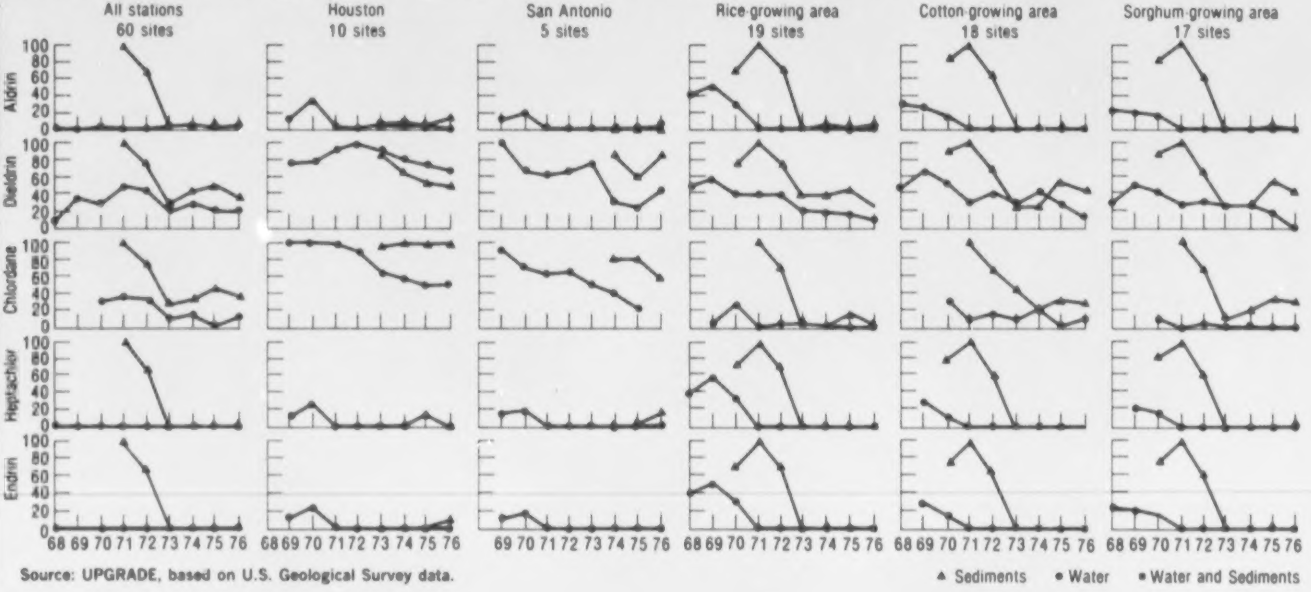
Annual Composite Detection Rates for DDT, DDD, and DDE in Water and Sediments at 60 Stream Monitoring Sites in Texas, Louisiana, and Oklahoma, 1968–76



Source: UPGRADE, based on U.S. Geological Survey data.

Figure 37

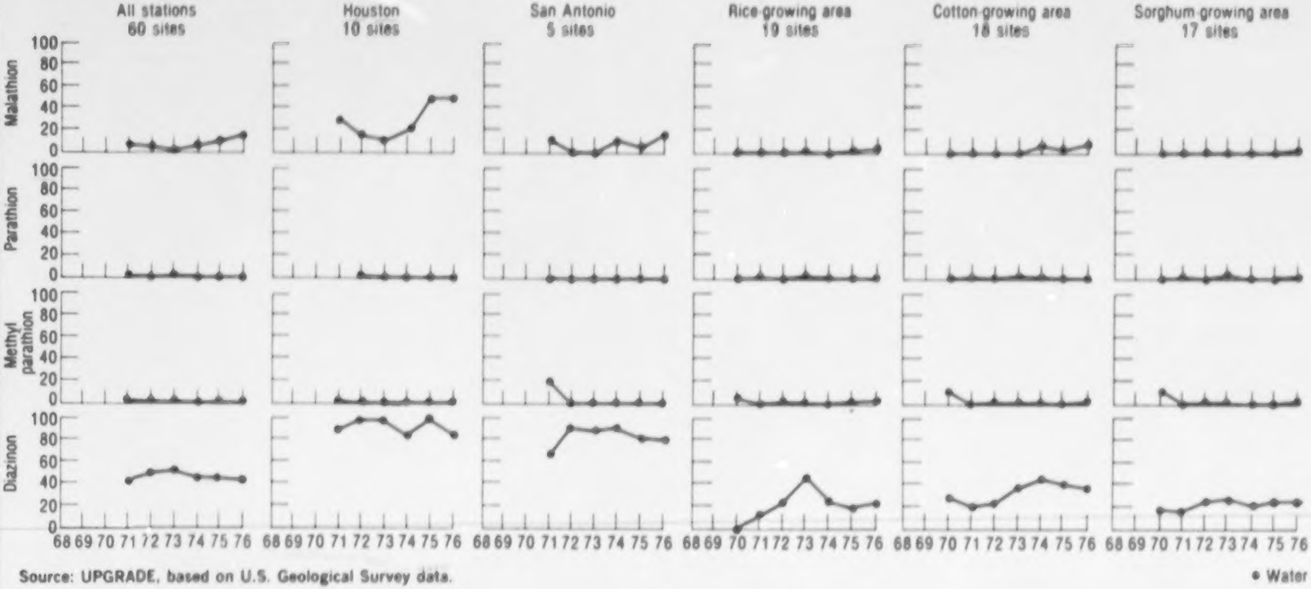
Annual Composite Detection Rates for Five Chlorinated Hydrocarbon Insecticides in Water and Sediments at 60 Stream Monitoring Sites in Texas, Louisiana, and Oklahoma, 1968–76



Source: UPGRADE, based on U.S. Geological Survey data.

Figure 38

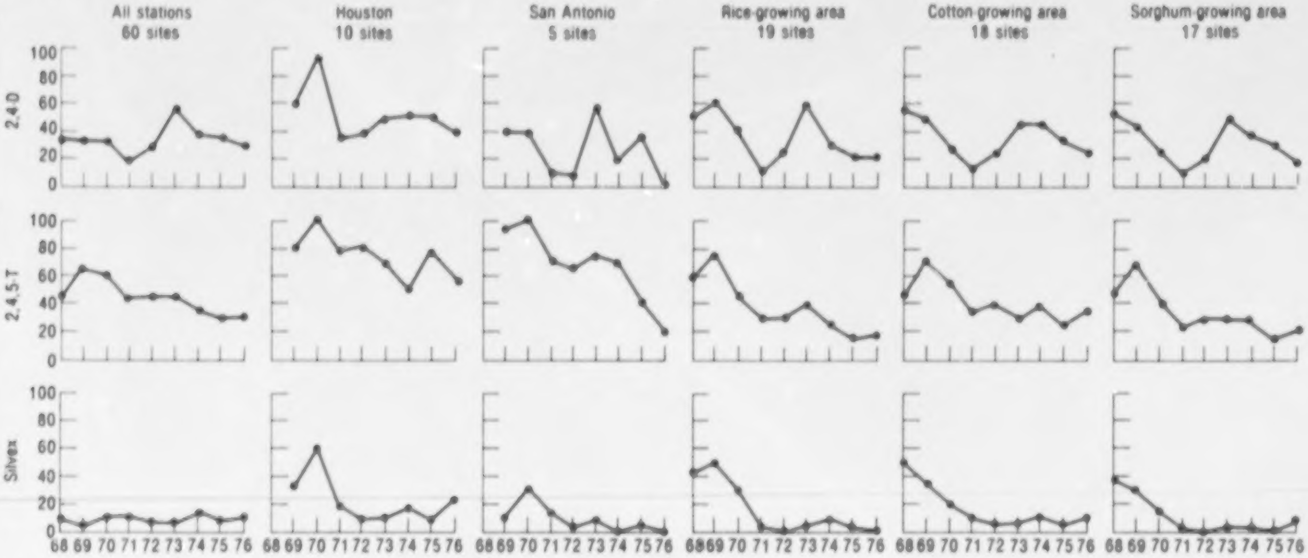
Annual Composite Detection Rates for Four Organic Phosphate Insecticides in Water at 60 Stream Monitoring Sites in Texas, Louisiana, and Oklahoma, 1968–76



Source: UPGRADE, based on U.S. Geological Survey data.

Figure 39

Annual Composite Detection Rates for Three Herbicides in Water at 60 Stream Monitoring Sites in Texas, Louisiana, and Oklahoma, 1968–76



Source: UPGRADE, based on U.S. Geological Survey data.

generally indicative of industrial water pollution from point and nonpoint sources.

Before World War I, almost all of the phenol manufactured in the United States was derived from coke oven and coal tar distillation. Today most phenol is produced synthetically. It is used in many industrial and commercial applications, including wood preservatives, plywood adhesives, gasoline additives, and the production of pesticides, plasticizers, and epoxy resins. In addition, phenol and related phenolic chemicals enter waterways as waste products from a variety of industries. Major dischargers include petroleum refineries and manufacturers of iron and steel, ferroalloys, textiles, plastics and synthetics, and other chemicals.

As water pollutants, phenol and phenolic compounds can be toxic to fish and other aquatic life, and they are well-known sources of odor and taste tainting problems in drinking water and fish flesh. Chlorophenols, an important class of phenols that cause tainting, are often produced by the chlorination that is widely practiced to decontaminate public water supplies and treated sewage.

The Council recently analyzed phenol pollution of the Ohio River and its major tributaries (Figure 40). This watershed contains a heavy aggregation of industrial facilities that produce phenols as waste byproducts. During the 1920's, public water supplies along the Ohio River were badly tainted by large amounts of phenolic com-

Figure 40

Phenol, Ohio River Basin Water Quality Monitoring Sites, 1976

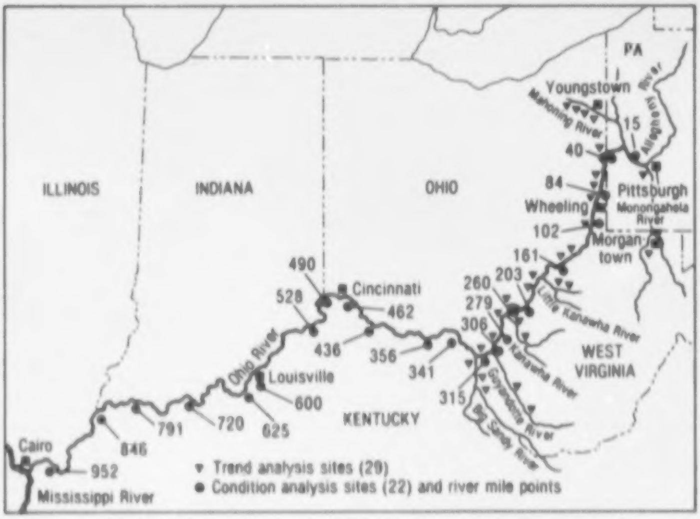
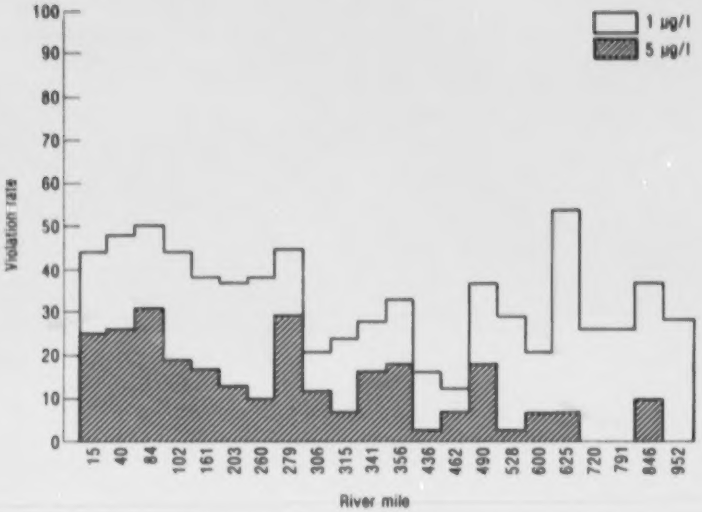

PA
Youngstown
Mahoning River
Allegheny River
15
40
84
Pittsburgh
Monongahela River
Wheeling
102
Morgantown
161
203
260
279
306
Little Kanawha River
Kanawha River
WEST VIRGINIA
315
Guyandotte River
Big Sandy River
ILLINOIS
INDIANA
OHIO
490
528
Cincinnati
462
436
356
341
Ohio River
Louisville
600
625
720
791
846
KENTUCKY
Cairo
952
Mississippi River
▾ Trend analysis sites (29)
● Condition analysis sites (22) and river mile points

Figure 41

Phenol, Violation Rates,[1] Mainstem of the Ohio River (22 Sites), 1976



[1] Violation rate = percent of observations which exceeded the benchmark level of 1.0 micrograms per liter and 5.0 micrograms per liter.

Source: UPGRADE, based on Ohio River Sanitation Commission data.

pounds that were discharged in untreated wastes from coking plants. The problems are less severe today because of industrial treatment practices.

The present pattern of phenol contamination of the Ohio River's 981-mile main stem is shown in Figure 41, which shows the 1976 violation rates for phenols as measured at 22 monitoring stations by the Ohio River Sanitation Commission. Two benchmarks were used in calculating the violation rates: the 1 microgram-per-liter water quality criterion, which is the standard used by Ohio and Illinois and is recommended by EPA for the protection of public water supplies, and the more serious 5 microgram-per-liter level, which is the water supply criterion adopted by Pennsylvania and West Virginia.

Over the entire length of the river, an average of 35 percent of all phenol measurements in 1976 exceeded the 1 microgram-per-liter criterion EPA recommends for protecting water supply sources. The more serious level of 5 was violated 13 percent of the time. Figure 41 shows that the first 84 miles of the river, from Pittsburgh to Wheeling, have serious phenol problems. The EPA criterion is violated there nearly one-half the time, and the 5 level is violated in about one-fourth of all measurements. This upstream stretch of the Ohio River and its upstream tributaries receive phenolic wastes from many industrial facilities involved in steel production, petroleum refining, coking operations, and chemical production. These wastes are added to the high levels of phenols caused by nonpoint sources in the watershed, causing high violation rates in the industrialized areas.

Substantial violations continue downstream for the next 200 miles or so, although microbial action and dilution cause some reductions in phenol levels where industry contributes little. After the Kanawha River enters the Ohio at mile 270, the situation improves markedly except for problems immediately downstream of Huntington, West Virginia, Cincinnati, and Louisville.

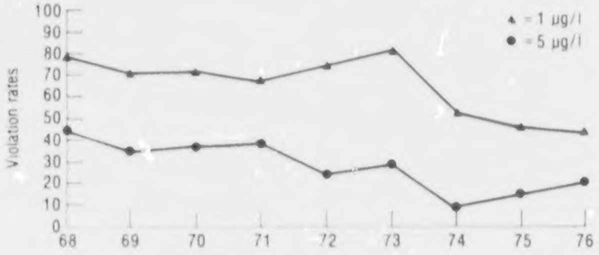
The worst part of the Ohio River for phenol contamination—the first 300 miles—has improved during the past few years. Between 1968 and 1976, the composite violation rates for phenol criteria dropped by one-half (Figure 42).

Improvements are also evident for most of the major tributaries of the upper Ohio River over the same time period. But the Mahoning River has remained grossly in violation. Although average phenol levels have improved in the Mahoning (Figure 43), it is the worst tributary for phenol pollution, with violations more than 90 percent of the time every year (Figure 44). Industrial dischargers, including iron and steel producers, blast furnaces, and coking operations, are heavily concentrated along the Mahoning between Struthers and Warren, Ohio.

The Mahoning River Basin has been the subject of intensive analysis by EPA because of the fear that imposing strict pollution control requirements on the antiquated iron and steel production facilities in the basin would lead to widespread social and economic disloca-

Figure 42

Phenol, Annual Composite Violation Rates,[1] Upper Ohio River (14 Sites), 1968–76

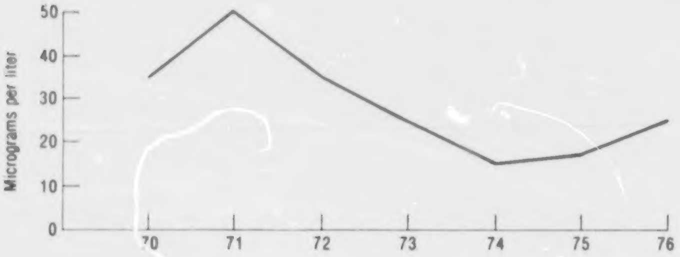


[1] Violation rate = percent of observations which exceeded the benchmark level of 1.0 micrograms per liter (▲) or 5.0 micrograms per liter (●)

Source: UPGRADE, based on EPA's STORET system data (14 sites) for 1968–75 and on Ohio River Sanitation Commission data (10 stations) for 1976.

Figure 43

Phenol, Annual Composite Median Values, Mahoning River (4 Sites), 1970–76



Source: UPGRADE, based on EPA's STORET system data.

tion. As a result, EPA established a revised less stringent abatement schedule for the Mahoning's steel industry. However, this decision would only further delay improvement in the seriously polluted river. In the summer of 1976, the EPA decision was challenged in suits filed by the state of Pennsylvania, the Sierra Club, and other organizations.

Other tributaries have shown more encouraging trends than the Mahoning (Figure 44). Besides the pollution abatement requirements of Public Law 92-500 and the NPDES permit program, a Pennsylvania boat surveillance program seems to have helped in the cleanup. In 1972, boat surveys began monitoring industrial facilities along the Monongahela and upper Ohio Rivers. Figures 42 and 44 show some rather sharp declines in phenol violations after 1972.

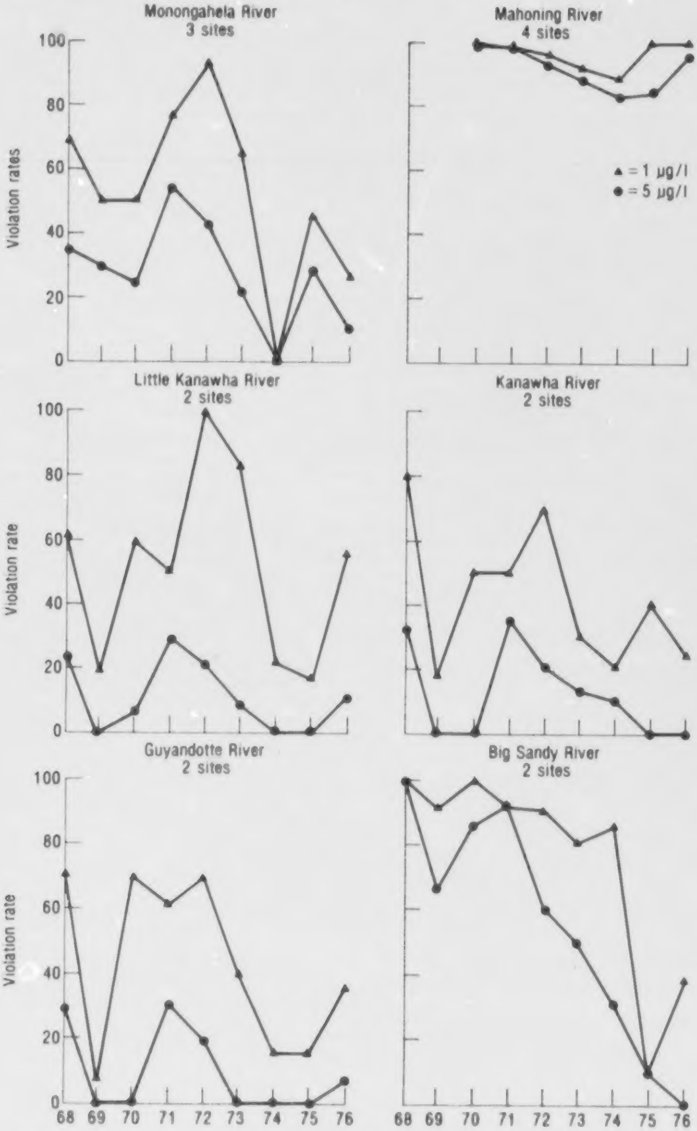
Another probable reason for the improvements in phenol levels is the improved controls on acid mine drainage of recent years. Control of acidity in tributaries of the upper Ohio River has allowed increased microbial action to reduce the levels of phenols.

THE GREAT LAKES

The Great Lakes must certainly be counted among the most important natural resources of North America. One out of every seven U.S. citizens lives in the Great Lakes basin and depends in many ways on these immense natural reservoirs of one-fifth of the world's freshwater. The Great Lakes have been central to the economic and social history of the United States, and their potential value to the nation increases as other water resources become more scarce. But because of their size and slow rate of flushing, the Great Lakes are

Figure 44

Phenol, Annual Composite Violation Rates,[1] Nine Major Tributaries of the Ohio River, 1968–76



[1] Violation rate = percent of observations which exceeded the benchmark level of 1.0 micrograms per liter (▲) or 5.0 micrograms per liter (●).

Source: UPGRADE, based on EPA's STORET system data.

especially vulnerable. Once altered or contaminated, they obviously will be slow to recover when recovery is even possible.

Present water quality problems of the Great Lakes may be categorized as eutrophication, toxic pollutants and special problem locations.

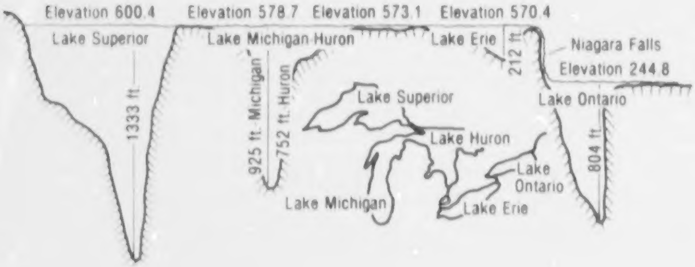
Immense as they are, the Great Lakes are subject to eutrophication and other grand-scale alterations caused by human activity. Thus far, the open waters of Lakes Superior, Michigan, and Huron are still generally good as judged by federal water quality criteria and state standards. However, the lower Great Lakes—Erie and Ontario—show signs of significant degradation even in their offshore waters, and the upper lakes exhibit early signs of undesirable alteration.

Lake Erie has long been the focus of concern. Algal blooms, beach closings, bottom sludge deposits, oxygen depletion, taste and odor problems, and fish contamination in the western and central basins have caused much speculation about the "death" of Lake Erie. However, because Lake Erie is shallow compared with the other Great Lakes (Figure 45), it is potentially capable of a somewhat faster recovery. A number of recent pollution abatement actions have achieved a degree of success. Although it is still the most degraded of the Great Lakes, Lake Erie's loadings of sewage, phosphorus, phenols, mercury, chloride, and other pollutants have been significantly reduced in the past few years.

To a lesser degree, Lake Ontario also shows signs of widespread degradation—beach closings due to high bacterial levels, nuisance shoreline growths of the alga *Cladophora*, and contamination of fish by PCB's and mercury. Some recent improvements have occurred,

Figure 45

Great Lakes Water Levels, 1860–1975[1]


Elevation 600.4
Lake Superior
1333 ft
Elevation 578.7
Lake Michigan-Huron
925 ft. Michigan
752 ft. Huron
Elevation 573.1
Lake Erie
212 ft
Elevation 570.4
Niagara Falls
Elevation 244.8
Lake Ontario
804 ft
Lake Superior
Lake Huron
Lake Ontario
Lake Michigan
Lake Erie

[1] Scales have been distorted to convey visual impression of differences in elevation. Lake levels shown represent average annual elevation for 1860 to 1975.

Source: International Joint Commission, Canada and the United States, *Further Regulation of the Great Lakes*, 1976, p. 8.

such as reduced phosphorus loadings from the Niagara River and sewage treatment improvements at several urban areas, but Lake Ontario's nutrient levels have already reached the point at which nuisance algae growth can occur wherever physical conditions (light, temperature, and substrate) are suitable.

Toxic pollutant contamination of water, sediments, and aquatic life is another important class of problems found in varying degrees in the Great Lakes. PCB's, asbestos-like fibers, heavy metals, pesticides, and other toxic substances threaten human health and Great Lakes ecosystems.

PCB levels in fish tissues, for example, have been regularly observed in violation of the FDA limit of 5.0 parts per million since 1971, occurring in all five of the Great Lakes in lake trout, coho salmon, carp, chubs, and many other species. Reductions in PCB use and the elimination of known PCB sources in the upper Great Lakes basin have caused PCB levels to decline significantly in Lake Huron's Saginaw Bay, but no improvements have yet been observed in Lakes Michigan and Superior.

Heavy metals such as zinc, lead, and nickel have been a chronic contamination problem in some harbors and nearshore sediments of the Great Lakes. Mercury has been the metal of greatest concern for the past 7 years. During 1970–71, mercury was discovered to be in excess of the 0.5 part per million FDA limit in the tissues of several species of Lake Erie and Lake St. Clair fish. The limit was also violated in at least one species from Lakes Superior, Huron, and Ontario. In 1970, all commercial fishing in Lake St. Clair was banned because of mercury, as was commercial walleye fishing in Lake Erie's western basin. By 1975 the curtailment of industrial discharges of the metal has caused mercury levels to decline about 60 percent in most species of fish in Lakes Erie and St. Clair. However, violations of the FDA limit are still being reported in Lakes Erie, St. Clair, Ontario, and Superior.[48]

DDT-contamination of Lake Michigan fish was a severe problem in the late 1960's, when the FDA limit of 5 parts per million in fish tissues was widely violated. The levels have declined significantly since the 1972 ban on DDT use in parts of the Lake Michigan watershed. However, lake trout from Lakes Michigan and Superior still violate the FDA limit for DDT. Other pesticide problems are failing to show improvement. The state of New York banned consumption of seven species of Lake Ontario fish because of violations of the FDA limit for Mirex (0.1 part per million) observed in 1976. In addition, dieldrin levels in Lake Michigan fish regularly average just below the FDA limit of 0.3 part per million.[49]

No clear distinction can or should be made between local and widespread pollution problems in the Great Lakes because the widespread problems are due to multiple local causes. Nevertheless, there are several acute problem locations—or pollution "hot spots"—on the Lakes. They are shown in Figure 46.

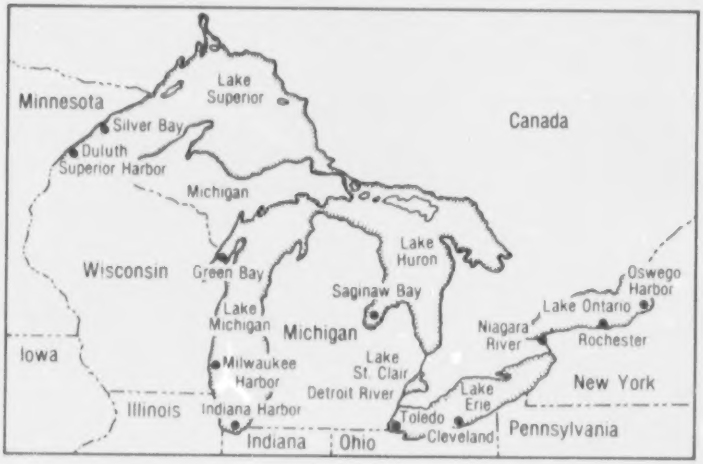
ENVIRONMENTAL HEALTH

Drinking water is a direct and universal environmental influence on human health. In our last annual report, we reported growing concern about known and suspected cancer-causing agents in drinking water. This year we are focusing on the possible relationship between drinking water and heart disease.

It has long been suspected that "hard" drinking water exerts a protective effect—reducing the incidence of cardiovascular disease—but the evidence has not been conclusive. Using both maps and statistical techniques, the Council finds confirmation for reports that death rates from cardiovascular disease tend to decrease as the "hardness" of drinking water increases. More specifically, our data indicate higher death rates from acute coronary heart disease and stroke in soft water areas. A wide range of chemicals may be responsible for the so-called protective effect of hard water. Further, there are indications that the effects of drinking water on heart disease, though generally consistent and predictable, may be small compared with such well-established risk factors as nutrition and socioeconomic status.

Figure 46

Major Water Pollution Problem Locations in the Great Lakes, 1976


Lake Superior
Minnesota
Canada
Silver Bay
Duluth
Superior Harbor
Michigan
Lake Huron
Wisconsin
Green Bay
Saginaw Bay
Oswego Harbor
Lake Ontario
Lake Michigan
Michigan
Niagara River
Rochester
Iowa
Milwaukee Harbor
Lake St. Clair
New York
Detroit River
Lake Erie
Illinois
Indiana Harbor
Toledo
Cleveland
Pennsylvania
Indiana
Ohio

Source: U.S. Environmental Protection Agency, *National Water Quality Inventory: 1976 Report to Congress* (Washington, D.C.: Government Printing Office, 1977), EPA-440/9-76-024, p. 31.

The mapping techniques we have used to examine the drinking water-heart disease relationship may be applied to a broad range of environmental health problems. In a preliminary inquiry into the usefulness of the technique, we produced maps of mortality rates from two categories of chronic respiratory disease. Although death rates from respiratory cancer display an expected clustering around the nation's urban centers, other chronic respiratory diseases show a different geographic distribution, with the highest rates in mountainous areas. This preliminary finding poses intriguing questions for further research.

HEALTH AND DRINKING WATER QUALITY

In 1848 John Snow, a physician and anesthesiologist for Queen Victoria, demonstrated the connection between drinking water and disease through mapping and survey techniques. Following his clinical intuition that outbreaks of cholera in the Golden Square section of London were somehow related to impure supplies of drinking water, Snow mapped reported cholera deaths and canvassed the area's households.[50] He showed that homes drawing their water from the river below a sewage outfall suffered a death rate from cholera six times that of households getting their water farther upstream. By the simple removal of the Broad Street pump handle, Snow at once began the science of analytic epidemiology and confirmed the presence of disease-carrying agents in drinking water.

By the early part of the 20th century, such treatment techniques as filtration and chlorination made it relatively safe to use major streams and rivers both as carriers of sewage and as sources of water supply. Because of the rapid adoption of water treatment practices, outbreaks of communicable disease transmitted by drinking water in the United States have declined to negligible proportions.[51] Advances in medical care combined with treatment of drinking water had reduced deaths from waterborne infections[52]—most notably cholera and typhoid fever—to less than one-tenth of 1 percent of U.S. mortality by 1970.[53]

The spread of infectious disease from waterborne contaminants is well under control, but close attention must be paid to concentrations of pollutants in bodies of water used for municipal supply. Unforeseen interruptions or fluctuations in the treatment process may temporarily expose communities to unsafe levels of contamination. Moreover, if drinking water reservoirs are to be used for swimming and boating, their high quality must be a point of continual concern.

The recent detection of small amounts of carcinogens in drinking water raises doubts about chlorination as a primary disinfection technique. Chlorinated organic compounds are numerous among the known and suspected carcinogens found in drinking water.[54] The likelihood that these compounds may be formed during the chlorination process creates a dilemma which has been identified but which we have not yet begun to solve. On the one hand, it is important to limit human contact with cancer-causing agents; on the other, it is essential to keep waterborne infections at their current low levels.

DRINKING WATER SUPPLIES

In order to characterize the quality of drinking water supplies, the Council examined EPA monitoring data on 159 cities which use only surface water. The data, which we also used to study heart disease relationships, consist of measurements of several untreated water supply variables, including fecal and total coliform bacteria (two of the most frequently used indicators of microbiological water quality), and of many chemicals.

In many sources of municipal supply, bacteria often rise above levels considered safe for drinking water supply and far above safe swimming levels. Indeed, our analysis shows that average concentrations of fecal and total coliform bacteria exceed suggested safe limits in one-fourth and one-fifth, respectively, of the supplies studied (see Table 16). These figures understate the problem because they are based on *average* violations; additional areas violate safe limits at least part of the time.

This substantial and widespread contamination indicates that without adequate alternatives it may not be safe to reduce chlorination of drinking water and municipal waste water in the interest of controlling formation of carcinogenic compounds. Although the ideal approach would be to prevent contaminants from entering drinking water supplies in the first place, such problems as urban and agricultural runoff and overburdened waste treatment systems may make it impossible to reach this goal in the near future.

Results of our study of chemical constituents were mixed (see Table 16). None of the water supplies studied was in violation of recommended standards for barium, boron, chromium, silver, or zinc. For 6 of the 16 chemical constituents studied, however, at least 10 percent of the water supplies exceeded established limits. Cadmium, cyanide, manganese, and, particularly, phenols exhibited the most widespread violation rates. This group of chemicals suggests pollution from industrial sources, especially those engaged in large-scale electroplating, battery manufacture, or petrochemical processing.

Many of the recommended limits for untreated water supplies are identical to EPA's proposed standards for treated water under the Safe Drinking Water Act of 1974,[55] which applies to all public water systems. Although acute toxicity is the primary concern, maximum permissible limits must also take into account possible long-term health effects. The reported inverse association between "hard" water and the various heart diseases, which account for one-half of all fatalities in this country, deserves close attention.[56]

Table 16

Violations of Recommended Limits for Mean Concentrations of Selected Water Quality Constituents in 138 [1] Municipal Supply Sources, 1955–77

Water quality constituent	Recommended limit [2]	Number of means available [1]	Number in violation	Percent in violation
Biological				
Fecal coliforms	2,000/100 ml [a]	66	16	24.2
Total coliforms	20,000/100 ml [a]	43	9	20.9
Biochemical oxygen demand	5.0 mg/l [b]	64	5	7.8
Dissolved oxygen [3]	5.0 mg/l [b]	91	1	1.1
Chemical				
Arsenic	0.05 mg/l [c]	63	4	6.4
Barium	1.0 mg/l [c]	38	0	0
Boron	0.750 mg/l [c]	40	0	0
Cadmium	0.01 mg/l [c]	61	14	23.0
Chloride	250 mg/l [c]	127	1	0.9
Chromium	0.05 mg/l [c]	41	0	0
Copper	1.0 mg/l [c]	68	1	1.5
Cyanide	0.2 mg/l [a]	36	9	25.0
Iron	0.3 mg/l [c]	45	7	15.6
Lead	0.05 mg/l [c]	60	6	10.0
Manganese	0.05 mg/l [c]	40	14	35.0
pH (lower limit) [3]	5 [c]	110	1	0.9
pH (upper limit)	9 [c]	110	3	2.7
Phenols	0.001 mg/l [c]	36	33	91.7
Silver	0.05 mg/l [c]	50	0	0
Sulfate	250 mg/l [c]	111	1	0.9
Zinc	5.0 mg/l [c]	62	0	0

[1] Constituent coverage varies considerably among monitoring stations.

[2] Recommended limits:

[a] National Academy of Sciences, *Water Quality Criteria, 1972* (Washington, D.C.: Government Printing Office, 1972), No. 5501-00520.

[b] Arbitrary benchmark established by CEQ.

[c] Environmental Protection Agency, *Quality Criteria for Water* (Washington, D.C., 1976), EPA-44019-76-023.

[3] Values below these limits are considered in violation.

Source: UPGRADE, based on EPA'S STORET system data.

DRINKING WATER AND HEART DISEASE

Research on the relationship between drinking water and cardiovascular disease began about 20 years ago. A 1957 study related highly acidic river waters in Japan to deaths from stroke.[57] At the same time, U.S. researchers reported a distinct but unexplained geographic pattern of cardiovascular mortality,[58] initiating a wave of investigations on drinking water-heart disease hypotheses.

This line of research has brought forth a large and occasionally conflicting literature.[59] Few of the studies have been able to follow the most desirable method, leading to the most impregnable results—tracking large numbers of exposed and unexposed individuals.[60] Rather, most studies analyze populations, comparing disease and fatality rates with estimated chemical concentrations in water supplies. The majority of these studies have shown significant inverse relationships between water hardness and mortality from one or more forms of cardiovascular disease, suggesting that hard water may in some way be "protective" or that a constituent of soft water may contribute to development of fatal heart disease.

Public water suppliers often deliberately alter the hardness of drinking water or its acidity, chlorine, or fluorine levels prior to distribution. Standard treatment may unintentionally affect concentrations of other chemicals in water, though little is known of these effects. The miles of pipes used for distribution offer occasion for further alteration—chemical levels may be lowered by the formation of precipitates or raised by leaching and chelation.

Practical as well as theoretical considerations arise from these deliberate and incidental changes in the natural chemical composition of the water. If we are removing beneficial substances or adding harmful ones, we need to know it.

Recommendations have been made to stop or to reduce the widespread softening of drinking water both in homes and during municipal treatment or even to harden water artificially for the explicit purpose of reducing deaths from heart disease. In 1971, Great Britain's Chief Medical Officer advised that proposed softening programs should "take account of the relatively worse (cardiovascular disease) experience in areas where the hardness of water supply has been reduced." [61]

Similarly, in May 1977 the National Academy of Sciences predicted a possible 15 percent reduction in heart disease mortality by manipulation of the nation's water supplies but stressed that the specific alterations have yet to be determined.[62]

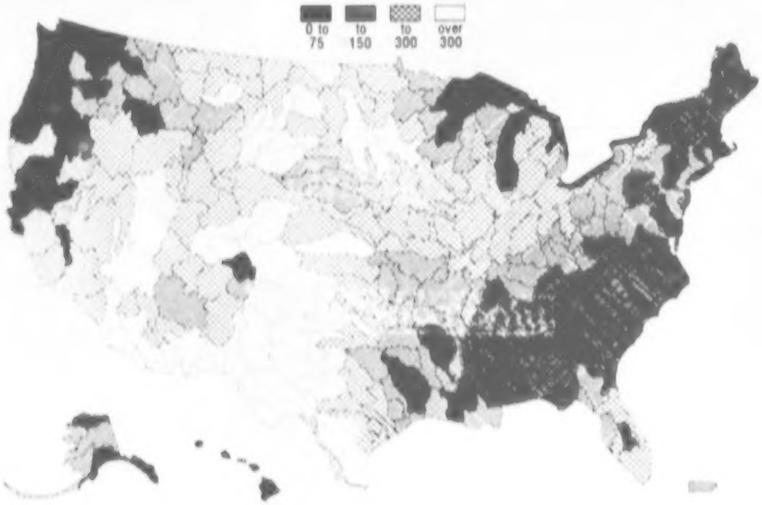
Evidence from the drinking water-heart disease literature does not yet warrant definitive public health action. Population studies may be valuable and suggestive, but without corroboration from clinical and epidemiological research, they are not reliable enough to guide preventive action.[63]

Long-term studies of individuals, with data on environmental factors to which they are exposed, are necessary for assessment of risk. The primary value of studies which focus on populations as opposed to individuals is in forming new hypotheses concerning the environment and health and in tracking progress in large-scale preventive or therapeutic programs. We designed our study to find support—or the lack of it—for the reported relationships between heart disease and drinking water.

The geographic distributions of water softness and heart disease are similar, as shown in Figures 47 and 48. The southeastern United States, with its high precipitation and mineral-poor soil, has by far the softest naturally occurring surface water in the country. Cardiovascular death rates in this region are consistently high. The northeast and mideast sections have relatively soft water and a fairly

Figure 47

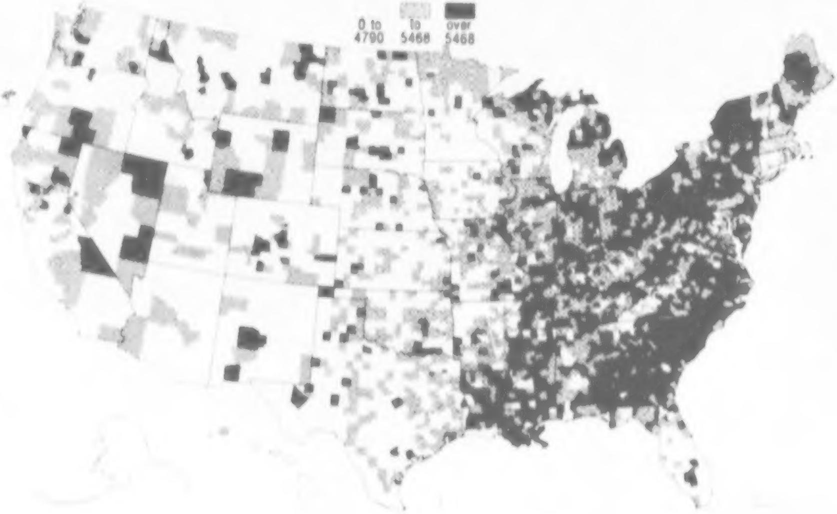
U.S. Water Hardness, Water Year 1975
(milligrams per liter) (annual mean values)


0 to 75
to 150
to 300
over 300

Source: UPGRADE, based on U.S. Geological Survey's National Stream Quality Accounting Network data.

Figure 48

Cardiovascular Diseases, Age-Adjusted Mortality, 1968–72 (million population)


0 to 4790
to 5468
over 5468

Source: UPGRADE, based on U.S. Department of Health, Education and Welfare's National Center for Health Statistics data.

heavy concentration of high death rates from heart disease. West of the Mississippi and especially in the arid, mineral-rich Southwest, levels of water hardness are highest and cardiovascular mortality is generally quite low.

Although these maps depict the geographic distribution of diseases and their suspected environmental influences rather well, they are a poor representation of actual impacts on the population because the size of a state or county bears little relationship to its population. For example, because New Jersey is small, a conventional map obscures the fact that large numbers of people are affected there.

To alleviate this problem, CEQ created a population-based county map (Figure 49) which adjusts the area of each state and county to the size of its population. Heart disease death rates are then indicated on the map.

Another way of relating environmental factors to development of chronic diseases is statistical analysis. Table 17 shows significant correlations between average water hardness and heart disease in white males and females for our study base of 146 counties for which water quality data were available. Thirteen significant correlations result, all but two (for hypertension) with negative signs. Negative correlation coefficients indicate that as the hardness of drinking water increases, heart disease death rates tend to decrease.

Table 17

Significant[1] Correlations Between Hardness of Water Supply and Mortality Rates from Cardiovascular Diseases in 125 Counties[2] Using Surface Water, White Males and Females, 1968–72

Cause of death	White males	White females
Total cardiovascular diseases[3]	−.391	−.289
Rheumatic heart disease	NS[4]	NS
Hypertension	+.127	+.169
Acute ischemic heart disease	−.331	−.213
Chronic ischemic heart disease	−.160	−.212
Cerebrovascular disease	−.197	−.209
Arteriosclerosis, general	NS	NS
Aortic aneurysm	−.218	NS
Other arterial diseases	−.241	NS
Other heart diseases	NS	−.134
Congenital diseases of the heart and circulatory system	NS	NS

[1] All reported coefficients significant at at least the 90 percent confidence level ($P < 0.1$).

[2] Twenty-one of the 146 counties in the study group had no hardness values available.

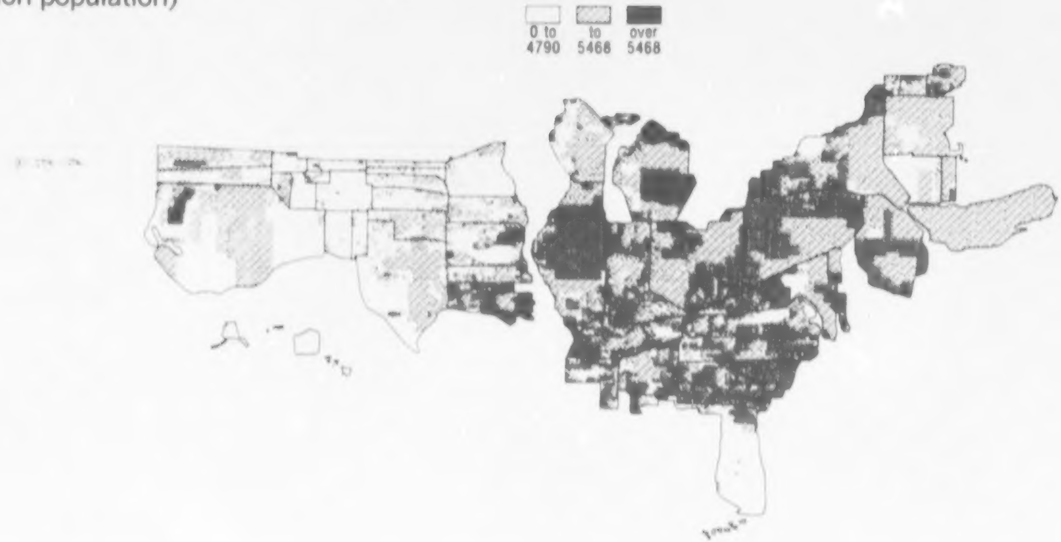
[3] Sum of all individual categories except "Congenital diseases of the heart and circulatory system."

[4] Not significant.

Sources: UPGRADE, based on National Center for Health Statistics and EPA's STORET system data.

Figure 49

Heart Disease, Age-Adjusted Mortality, 1968–72
(million population)


0 to 4790
to 5468
over 5468

Source: UPGRADE, based on U.S. Department of Health, Education and Welfare's National Center for Health Statistics data.

There appears to be a reliable, consistent association between soft water and stroke in the U.S. population. Support for this observation is lent by maps of the major specific heart disease categories. The distribution of deaths from stroke, shown in Figure 50, most closely parallels the water softness pattern in Figure 47.

The maps for acute and chronic ischemic, or coronary, heart disease (Figures 51 and 52), which includes heart attacks and arteriosclerotic heart disease and accounts for two-thirds of all fatal heart disease,[64] show no such close adherence to the general water hardness patterns. Nevertheless, the correlations for 125 water supply areas do indicate definite statistical relationships between soft water and ischemic heart disease for white men and women.

The positive correlations observed between hardness of water and hypertension are surprising in view of recent reports that this heart disease category is likely to evidence the "protective" effects of hard water.[65] Nationwide maps (not included) show little similarity in pattern between death rates from hypertension and water hardness.

It should be noted that the coefficients of correlation in Table 17, although they indicate a reliable connection between categories of heart disease and water quality, are small (at best accounting for 15 percent of the variation in heart disease death rates). This fact indicates that although the water effect is statistically detectable, it may be relatively weak, which tends to support the hypothesis that such well-known heart disease risk factors as socioeconomic status, diet, and stress may overshadow the suspected water factor.

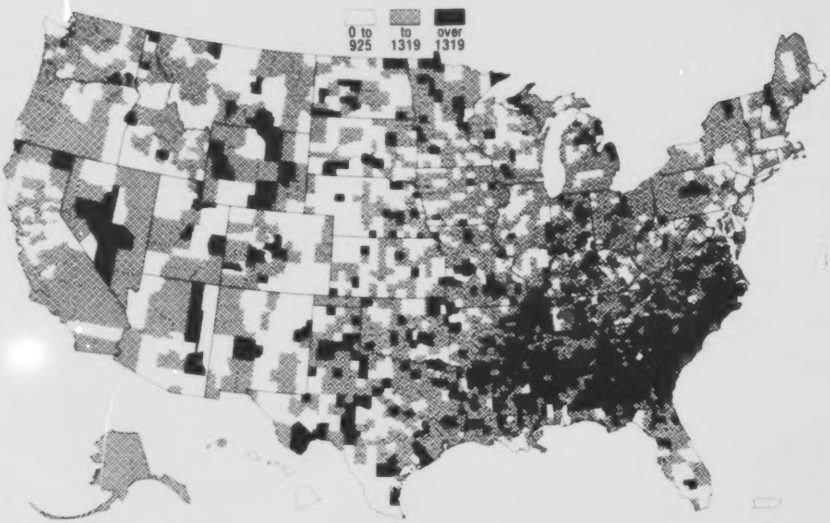
In order to investigate further the possible existence of a drinking water-heart disease relationship, it is necessary to go beyond hardness. The term was originally used to describe the ability of water to turn soap into a lather. As commonly measured,[66] hardness indicates the presence of polyvalent metal ions, principally calcium and magnesium. It is thus a very imprecise descriptive term, and discussion of hardness per se in relation to health is inappropriate. Both the National Technical Advisory Committee to the Secretary of Interior and the National Academy of Sciences have suggested discontinuing its use as a quantitative water quality criterion.[67] Ironically, hardness appears to be one of the variables most frequently measured by water quality monitoring stations.

In order to determine just what constitutes "hard" water, we have computed coefficients of correlation between hardness and 32 other variables, listed in Table 18. Twenty-one—nearly two-thirds of the variables—exhibit statistically significant positive associations with hardness levels. Hardness, then, is a rough indicator of waters rich in these trace chemicals, much as coliform bacteria counts indicate general microbiological contamination.

Calcium and magnesium are bulk ions which comprise the major portion of measured hardness. Correlations between these two elements and total cardiovascular disease revealed stronger statistical

Figure 50

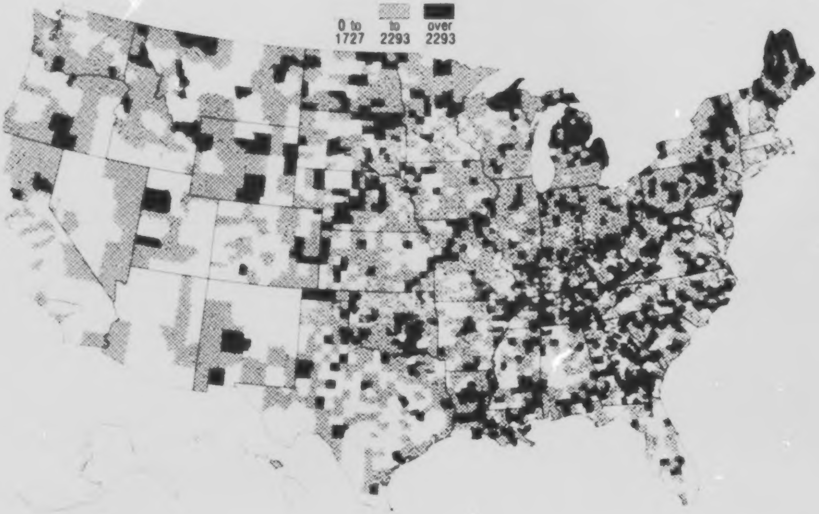
Cerebrovascular Disease, Age-Adjusted Mortality, 1968–72 (million population)


0 to 925
to 1319
over 1319

Source: UPGRADE, based on U.S. Department of Health, Education and Welfare's National Center for Health Statistics data.

Figure 51

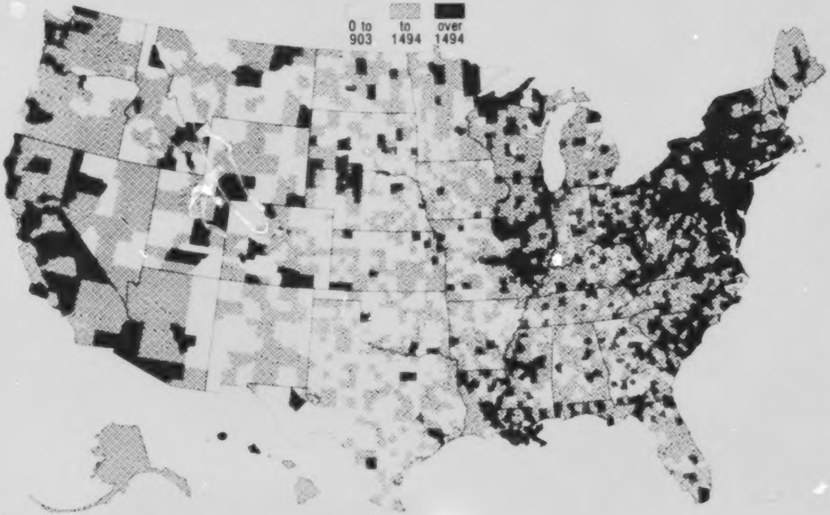
Acute Ischemic Heart Disease, Age-Adjusted Mortality, 1968–72 (million population)


0 to 1727
to 2293
over 2293

Source: UPGRADE, based on U.S. Department of Health, Education and Welfare's National Center for Health Statistics data.

Figure 52

Chronic Ischemic Heart Disease, Age-Adjusted Mortality, 1968–72 (million population)


0 to 903
to 1494
over 1494

Source: UPGRADE, based on U.S. Department of Health, Education and Welfare's National Center for Health Statistics data.

Table 18

Characterization of "Hard" Water in Sources of Supply for 146 Counties Using Surface Water

Constituents positively correlated with hardness [1]	Constituents showing no significant association with hardness [2]
Alpha radiation	Beta radiation
Ammonia-nitrogen	Copper
Arsenic	Cyanide
Barium	Fluoride
Beryllium	Iron
Bicarbonate ion	Lead
Boron	Manganese
Cadmium	Nickel
Calcium	Nitrate
Carbonate ion	Phosphate
Chloride	Zinc
Chromium	
Cobalt	
Magnesium	
Nitrate	
Potassium	
Phosphorus	
Silver	
Sodium	
Sulfate	
Vanadium	

[1] All correlations significant at the 99.5 level of confidence ($P<.005$), except arsenic ($P<.05$).

[2] All correlations have negative signs and are not significant at the 90 percent confidence level ($P<0.1$).

Source: UPGRADE, based on EPA's STORET system data.

associations than were obtained for hardness itself.* Both ions have been mentioned in the literature as possible responsible agents for low heart disease mortality. In one major study, calcium alone was found to produce the strongest associations, apart from any effects by magnesium or by a wide range of social and environmental variables.[68] More recently, magnesium was identified as the constituent most likely to be causally related to low heart disease mortality.[69] Further analysis, including multivariate techniques, will be necessary to define more clearly the interrelationships between water quality constituents and their associations with heart disease mortality.

In summary, it appears that the frequently reported associations between drinking water softness and death rates from heart disease are supported by the data that we have analyzed. Preliminary analysis suggests that reductions in mortality from coronary heart disease and stroke may be the main result of any "protective" effect of hard water. The inverse relationship between hardness levels and cardiovascular mortality may be overshadowed among certain population groups by the stronger influence of other risk factors. A wide range of water quality constituents appear likely candidates as specific agents responsible for the observed "water factor," though none shows compellingly conclusive evidence.

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*$r = -.482$ and $-.436$ for calcium and $-.368$ and $-.387$ for magnesium ($P<.005$), males and females respectively.

RESPIRATORY DISEASE MORTALITY MAPS

Maps similar to those used to investigate the drinking water-heart disease connection may also prove useful in suggesting environmental factors in other diseases. In a preliminary research effort, CEQ has inspected patterns of mortality from diseases of the respiratory system.

Death rates from cancer of the respiratory system seem to cluster around the country's large urban centers, as would be expected (see Figure 53). With their extensive industrialization and automobile use, metropolitan areas generally suffer higher levels of airborne pollutants than the rest of the country.

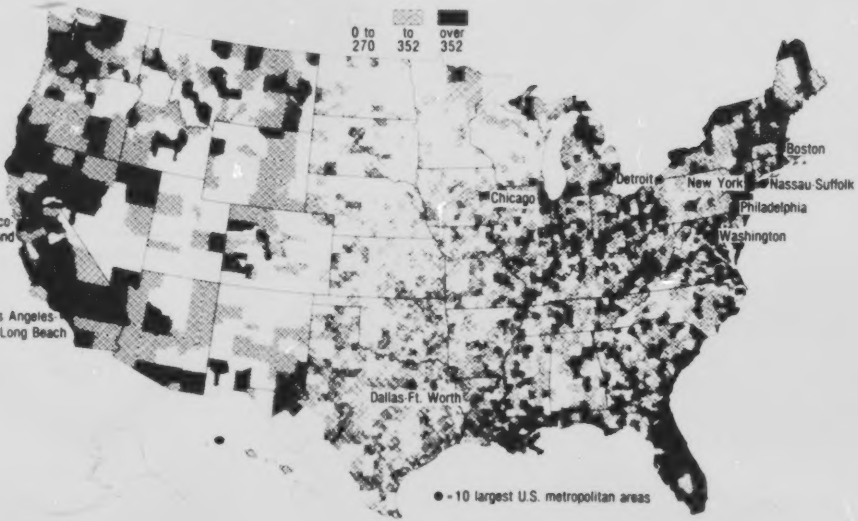
For the chronic respiratory diseases other than cancer—primarily bronchitis and emphysema—quite a different geographic pattern has emerged. Few major urban areas exhibit the highest rates of death from these diseases, as shown in Figure 54. Neither do they have exceptionally low rates. Rather, as Figure 55 shows, their rates are in the middle range.

Unexpectedly high rates are widely distributed from the Rocky Mountains west and appear in smaller bands through central Michigan, northern New England, and the Appalachian regions of Virginia, West Virginia, and Kentucky. Figures 56 and 57 show the differences in the number of people affected by the death rates of the two categories of respiratory disease; although most people live in areas with relatively high rates of respiratory cancer mortality, fewer people reside in areas with high noncancer death rates.

The varying distributions of respiratory mortality suggest some tentative hypotheses, which need to be tested by further research. It appears that the highest rates of death occur in high altitude areas, for example. A second possible explanatory factor may be that patients with chronic respiratory ailments move west on the advice of their physicians. Another explanation may be the occupational exposure of miners to coal and rock dusts in mountainous regions. These suggestions are speculative; research should be undertaken to test them and other hypotheses as possible explanations for the observed geographic pattern.

Figure 53

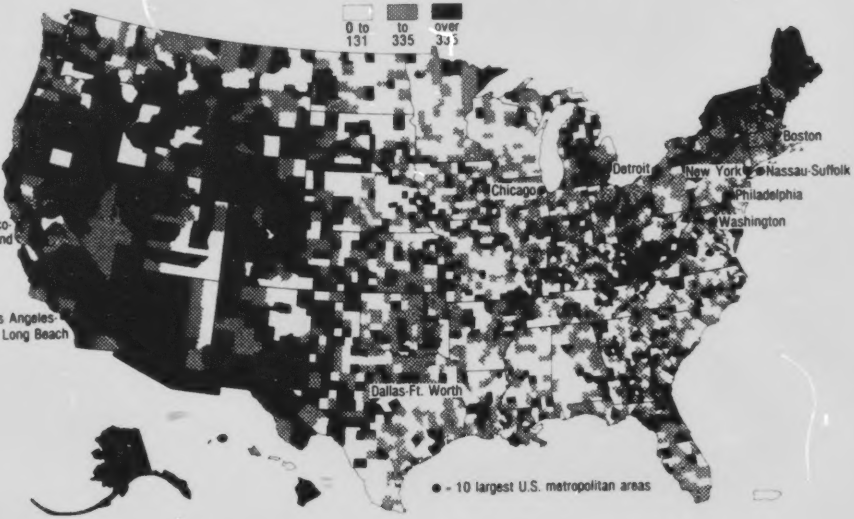
Respiratory Cancer, Age-Adjusted Mortality, 1968–72
(million population)


0 to 270
▨ to 352
■ over 352
San Francisco-Oakland
Los Angeles-Long Beach
Dallas-Ft. Worth
Chicago
Detroit
New York
Nassau-Suffolk
Boston
Philadelphia
Washington
● - 10 largest U.S. metropolitan areas

Source: UPGRADE, based on U.S. Department of Health, Education and Welfare's National Center for Health Statistics data.

Figure 54

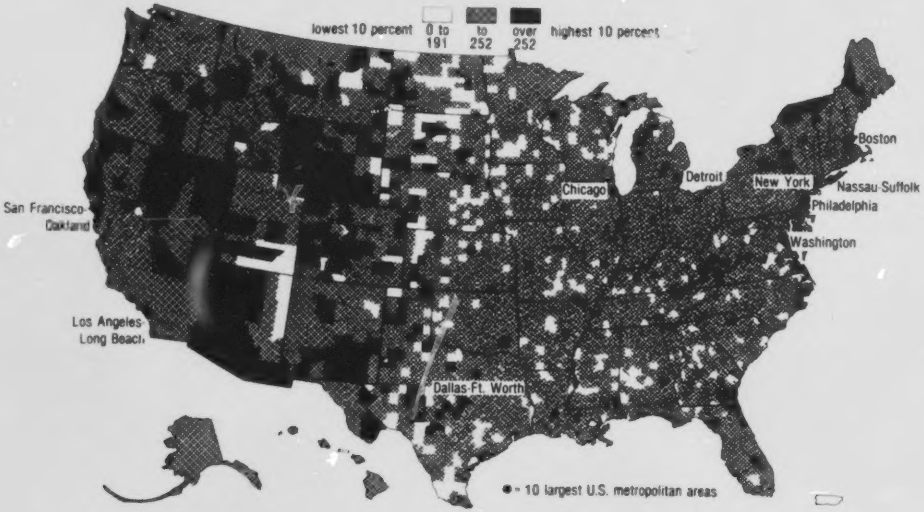
Chronic Respiratory Disease, Age-Adjusted Mortality, 1968–72 (million population)


0 to 131
to 335
over 335
Boston
Nassau-Suffolk
New York
Detroit
Chicago
Philadelphia
Washington
San Francisco-Oakland
Los Angeles-Long Beach
Dallas-Ft. Worth
● - 10 largest U.S. metropolitan areas

Source: UPGRADE, based on U.S. Department of Health, Education and Welfare's National Center for Health Statistics data.

Figure 55

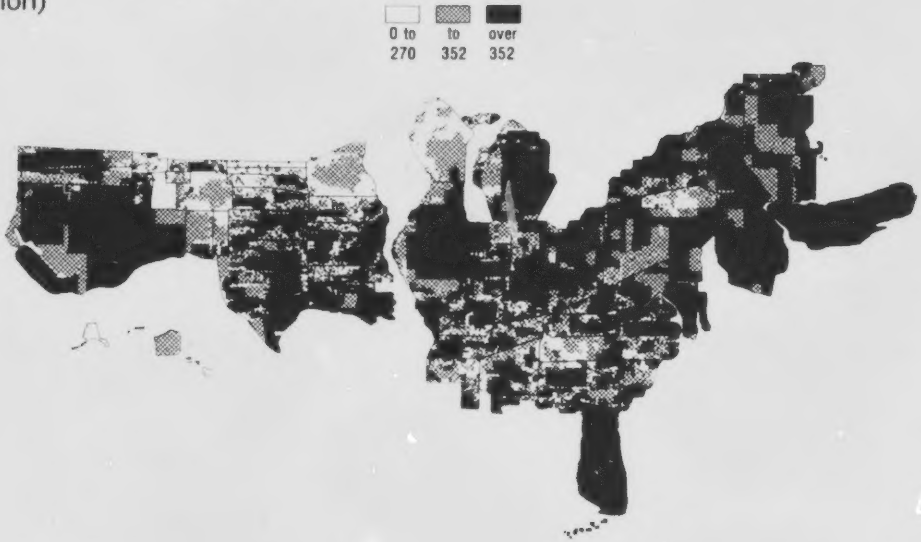
Chronic Respiratory Disease, Age-Adjusted Mortality, 1968–72
(million population)


lowest 10 percent
0 to 191
to 252
over 252
highest 10 percent
Boston
Detroit
New York
Nassau-Suffolk
Chicago
Philadelphia
Washington
San Francisco-Oakland
Los Angeles-Long Beach
Dallas-Ft. Worth
● = 10 largest U.S. metropolitan areas

Source: UPGRADE, based on U.S. Department of Health, Education and Welfare's National Center for Health Statistics data.

Figure 56

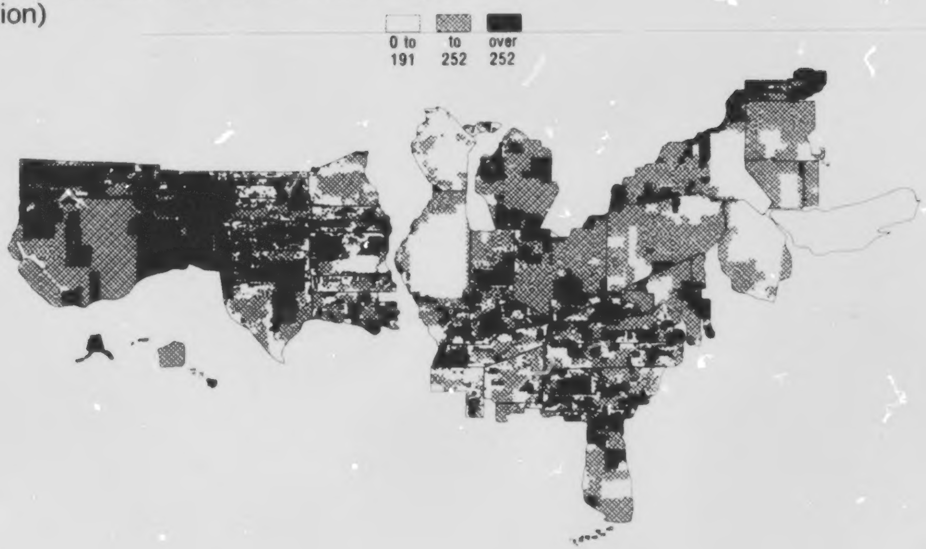
Respiratory Cancer, Age-Adjusted Mortality, 1968–72 (million population)



Source: UPGRADE, based on U.S. Department of Health, Education and Welfare's National Center for Health Statistics data.

Figure 57

Chronic Respiratory Disease, Age-Adjusted Mortality, 1968–72 (million population)



Source: UPGRADE, based on U.S. Department of Health, Education and Welfare's National Center for Health Statistics data.

ENERGY[70]

With oil and gas supplies dropping, demands rising, and oil imports increasing year by year, we would clearly benefit from new, secure sources of energy. The need is not confined to the United States; world energy demand is expected to double in 2 or 3 decades, and at the same time oil production is likely to level off.

The choice of technologies to meet the need for alternative energy sources is now the subject of intense debate, and two opposing points of view have emerged—the "hard" and the "soft" energy paths.

The "hard" path opts for redoubled efforts to develop all current energy sources, with a highly centralized, highly electrified energy future. For the near term, this approach calls for more of the same thing we have now, for as long as we can make it last. If natural liquid petroleum and gas are running out, then make more synthetically from coal and oil shales. At the same time, meet an increasing share of rapidly increasing energy needs with growth in electricity supply based on coal and nuclear power.

This view recognizes that eventually the fossil fuels may become too scarce, too expensive, or too environmentally damaging for continued use. But meanwhile, nuclear power will have come to maturity. The advocates place their confidence either in the breeder reactor, assuming that its safety and economic problems will be solved reasonably soon, or in the eventual success of nuclear fusion as an almost illimitable source of power. This view is imbued with the technological optimism that has been so much a part of the U.S. character for a century or more.

The "soft" path embodies the fundamental view that nature imposes limits on growth and that it is possible to live comfortably within those limits. Conservation is an indispensable part of this approach. Its advocates believe that greater efficiency can save large amounts of energy, but they also recognize that conservation may require at least moderate changes in habits and lifestyles. This approach emphasizes renewable, relatively nonpolluting, often decentralized, and small-scale sources of energy. Environmental effects of the technologies are described as tractable, reversible, and relatively small. More speculatively, advocates assert that job opportunities will be greater with the nonconventional technologies. And they believe that smaller energy enterprises near the communities which they serve will enhance self-reliance, a greater sense of civic responsibility, and a feeling of being in charge of one's destiny.

Obviously the two sides represent extreme positions. In fact, the paths that they describe are not necessarily mutually exclusive, and it is possible for the nation to adopt some elements of both. It is also evident that the arguments marshaled by both sides go beyond technical, environmental, and socioeconomic conditions to basic ethical values. In a democratic society, such questions can be decided only through the political process. Much of the information that citizens need is technical, environmental, and economic, but knowledge is primitive in some of the areas under debate. In the following discussion we summarize the arguments, point up the information gaps, briefly explore public policies favoring one or another kind of technology, and describe some of the more promising nonconventional technologies collectively termed "soft" or intermediate.

A COAL-NUCLEAR FUTURE

The immediate response to the energy crisis by government and the energy industries was to emphasize new energy sources that could be integrated easily into our vast existing transportation, distribution, and combustion systems. Because most of our remaining fossil fuel resources are coal and oil shale, it is logical with this approach to convert them into synthetic oil and gas so that they can be transported by existing pipelines, stored in existing storage tanks, and burned in standard cars, boilers, and home furnaces or to use them in the generation of electricity, to be distributed via existing grids. The transition to new energy sources, then, would disrupt our investments, equipment, and lifestyles as little as possible. Nuclear power would supplement coal in generating electric power. Admitting that nuclear energy is experiencing growing pains, this view holds that in maturity nuclear power could greatly reduce the mining damage caused by coal extraction, minimize the health hazards from the particulates and sulfur compounds released in burning coal, and lower the risks of climate modification from the carbon dioxide buildup that occurs with combustion of fossil fuels.

With the decline of high-grade uranium reserves, breeder technology would be developed and commercialized to make use of our vast reserves of uranium-238. Thermonuclear fusion may also be shown feasible some day and, if based on reactions that burn deuterium from the oceans, would be a source of energy virtually without limit.

A future can then be imagined that would rely on coal and uranium, making use of our present stock of oil and gas equipment in the near term and leading ultimately to an all electric economy based on a mature form of nuclear power that is essentially free of air pollution and uses almost inexhaustible sources of energy.

The picture is attractive in many ways. But the promise of abundant, environmentally benign nuclear power in the long-term future is no more than a promise; unsolved technological, economic, and social problems are formidable. Meanwhile, the environmental, social, and economic costs of intermediate forms of this energy future could prove heavy indeed. Disturbance of the land, rapid industrialization of pastoral communities in the West, heavy demands on scarce water for production of gas and oil from coal, air pollution from sulfur compounds and toxic trace metals, and large amounts of waste heat in air and water are all well-known environmental problems with use of coal. Likewise, unresolved questions about nuclear power could rather strictly limit its expansion—the hazards of plutonium, including possible spread of nuclear weapons, disposal of radioactive wastes, and safety.

A CONSERVATION-SOLAR FUTURE

A very different future is advocated by many environmentalists to avoid the pitfalls perceived in this coal-nuclear future. This other future is rooted in conservation and relies mostly on renewable resources for new supplies. Perhaps the most clearly stated defense of this general proposition is an article by Amory B. Lovins.[71] Although not without problems,[72] the Lovins article has become the most widely cited exposition of the idea that there is a viable and, indeed, more desirable solar alternative to the coal-nuclear system once thought inevitable.

Lovins and others developed their concepts by focusing on the features of existing and proposed energy systems that they find most objectionable. The U.S. Energy Research and Development Administration has estimated that in an intensely electric future 450 to 800 nuclear reactors, 500 to 800 coal-fired powerplants, 1,000 to 1,600 new coal mines, and some 15 million electric automobiles would be needed in the United States by the year 2000.[73] Lovins observed that this future would entail generating vast amounts of waste heat, enough to warm the entire freshwater runoff of the contiguous 48 states by 34–49° F; disrupting thousands of communities and millions of acres, often with little hope of restoration, to mine coal and uranium resources; sharply increasing the use of coal, which could double atmospheric carbon dioxide levels early in the next century, with the possibility of irreversible changes in global climate; relying increasingly on nuclear power, with increased risks of a major reactor accident and of proliferation of nuclear weapons; and suffering major economic difficulties as a result of the high capital costs and inflexibility of the "hard technologies." [74]

Working from these problem areas, Lovins and like-minded authors deduced a set of criteria for judging acceptability of competing energy systems. They argue that all proposed energy supply systems are more costly than available conservation options and that they will continue to be so for many years. For example, it is generally cheaper to save a barrel of oil with insulation or other conservation measures than to produce a barrel of oil from new wells, coal, or oil shales.[75]

As for security of supply, it is immediately obvious that reliance on finite supplies of fossil fuels engenders difficult national problems. Rather, it is clearly preferable to develop resources that are either renewable or inexhaustible when measured against projected use—solar energy in its many forms, geothermal energy, or nuclear energy from either breeder reactors or fusion. When fossil fuels have run their course, we will have to rely on renewable sources. Meanwhile, if we have invested heavily in synthetics made from coal in order to continue using our oil and gas equipment, we may have to pay a high conversion price later. So far there is little prospect that solar or nuclear energy can cheaply and conveniently produce enough gas and liquid fuels for the automobile and other oil and gas equipment.

The policy implication is that the energy systems we build tomorrow should be designed for compatible use with the inexhaustible energy sources of the day after tomorrow. That is, if coal is to be used heavily in the next few years to help meet our energy needs, it might be well to supply natural gas primarily for homes that already have gas furnaces and encourage solar power with electric backup for new buildings, or perhaps new buildings could be connected to a district heating system with boilers that could be converted from fossil fuels to geothermal, solar, or even trash-burning sources.

At least as important as economics is the environmental issue. Necessarily there are uncertainties about technologies that are under development, but research and development efforts on all new sources can be planned so that the control of pollutants and other impacts is an integral part of R&D. Judged on environmental effects, solar technologies appear the least threatening of emerging alternatives although the impacts of large-scale solar electric powerplants are uncertain.[76]

In any case, the environmental effects of most solar technologies appear minor compared with known effects of coal and nuclear power.

Yet comparisons do not provide a full answer. In examining competing technologies for the future, what we need to consider is not how bad the situation has been in the past but, rather, how acceptable it could be in the future—whether strip mined areas can be restored and underground mines made safe, whether particulate and sulfur oxide emissions can be controlled to avoid harmful health effects and safe, reliable methods be found to store long-lived radioactive wastes, and whether nuclear facilities can be shown safe enough so that public resistance to them will subside.

Answers to the questions are not obvious. In some areas basic and applied research is needed, and for now we must make choices in the face of uncertainty.

Another criterion by which to judge energy systems is their thermal and economic efficiency in meeting specific consumer needs. Lovins argues, for example, that it is wasteful to burn fuel to make electricity for the purpose of supplying resistance heating. First, two-thirds of the energy in the fuel is wasted at the powerplant; in addition, a vast network of costly transmission and distribution facilities is required to move the energy to the consumer, resulting in further costs and energy losses. The whole system yields only about 30 percent of the energy value of the original fuel. However, with an electric heat pump, it is possible roughly to double this overall system efficiency.

A further alternative could be to use small-scale decentralized systems located near the point of consumption to reduce conversion and transmission losses.[77] Examples are solar space heating systems, total energy systems supplying electric power and low grade heat for commercial establishments, electrical cogeneration at industrial plants to supply both electricity and high quality steam, and district heating systems to supply electricity and hot water for cities. These systems share the advantage of supplying the energy needed in the appropriate form, with few heat losses and with only a modest distribution system.

AREAS TO BE EXPLORED

Many other important questions have not been adequately considered by either conservationists or their critics. Among them are problems of reliability, system design, backup, and manpower requirements.

A good assessment of the reliability of nonconventional energy technologies is lacking. How often are they likely to fail? Will they require a considerable backup capability by the local conventional, nuclear, or coal-fired utility? What is the optimal onsite energy storage capacity? Are many individual systems likely to fail at the same time?

These questions should not imply that nonconventional energy sources are necessarily less reliable in supplying electricity to the consumer than large centralized systems. Indeed, experience with conventional fuels indicates that smaller units are more reliable—that is, power outages are less frequent. Recent findings suggest that when capacity is added to a system, 1 kilowatt of capacity near the consumer is worth 2.5 kilowatts of capacity at a distant central plant from the viewpoint of system reliability.[78] The reason lies not so much in the generating plant itself as in the transmission and distribution networks. Only 5 percent of power failures are caused at the generating plant; the rest occur in transmission, substation, or other distant facilities.[79]

Outages (from unanticipated failure) occur two to three times as often with large fossil fuel systems as with smaller units.[80] One study suggests that six 375 megawatt coal plants added to a system can provide the same level of service as two 1,200 megawatt plants and one 800 megawatt plant—even though the total capacity added is only 70 percent as great.[81] Another study concludes that three 400 megawatt coal plants could take the place of two 900 megawatt plants.[82]

The choice between large centralized generating plants and smaller more dispersed units is not clear cut. Further, many of the nonconventional technologies that appear promising for the future may have other problems of reliability that have nothing to do with size or distance from the consumer. The point to emphasize is that reliability of systems—not just the individual generating plant—must be taken into account. And reliability must then be weighed against other important benefits or drawbacks of each system.

Directly related to reliability are maintenance and costs. Generally speaking, frequent inspections and service or duplicate equipment can make systems more reliable. Either adds to the unit costs of delivered energy. What must be considered are the overall capital requirements of the new systems, including maintenance and backup; the employment implications; how many more jobs will be created; and whether they are high or low skill positions.

There are also important considerations of system design and operation. What is the best way to phase in the use of renewable and intermediate technologies? Should our transportation system become gradually electrified, or should suitable synthetic liquid fuels be developed from solar, nuclear, or fossil sources?

Solar systems raise some fundamental environmental issues. Although the amounts of energy extracted from the atmosphere or oceans will be minuscule compared with the total energy available, we cannot confidently predict the effects of widespread use of these technologies—for example, whether there is a maximum amount of power that can be extracted from the winds before unforeseen changes in the climate or the earth's energy balance begin to occur. Nor do we fully understand what effects can be expected in the deserts from operation of large-scale solar-electric plants. Are there maximum amounts of energy that can be withdrawn by ocean thermal conversion plants before the onset of detrimental effects to the oceans, lands or atmosphere?

INSTITUTIONAL BARRIERS

To achieve the national goals of conservation and more efficient use of remaining fossil fuel supplies and also to incorporate the newer technologies based on renewable sources, we will have to overcome institutional barriers. Cogeneration of electricity and industrial steam is an example of a readily available and often very economically favorable energy technology. Yet a mere fraction of the potential has been realized in the United States because many electric utilities—as regulated by state and local utility commissions—have policies that discourage cogeneration. Utility rate schedules and demand charges may make standby power from utilities more expensive than costs warrant. Thus industrial plants may be deterred from relying primarily on the power that they can produce together with process heat at the plant. At the same time, utilities have generally been unwilling to purchase electricity from industrial firms.

The policies that deter cogeneration result in part from the technical and managerial complications of operating an electrical grid with some power sources that are not under the utility's direct control. But another factor is entirely institutional—utility rate regulation, which uses invested capital as the basis for allowable profits. As regulated monopolies, utilities typically make little or no profit from purchasing electricity from an industrial firm. Industrial firms, for their part, are often reluctant to invest in cogeneration facilities because of the technical complexity and because of the fear that by generating electricity, the firms will be subject to state and federal public utility regulation. In addition, a question of ownership remains—whether cogeneration facilities should be owned by electric utilities or by industrial plants.

There is a growing awareness in state public utility commissions that cogeneration should be considered when additions to capacity are reviewed. The President's National Energy Plan makes several proposals to remove the institutional barriers to cogeneration.[83] First, firms generating their own electricity would be given fair rates both for the surplus power that they sell to utilities and for the backup power that they buy. Such industries would be exempt from federal and state public utility regulation and would receive an extra 10 percent tax credit for cogeneration equipment. Utilities should be encouraged to buy power at fair rates not only from industrial plants but also from small privately owned generating plants, small dams, windmills, or other facility that can generate power and conveniently supply it to nearby customers.

Both institutional problems and social and political factors tend to discourage wide adoption of district heating—the central distribution of heat to offices, stores, apartments, and other nearby buildings. Among the problems are:

- No strong industry organization vigorously promotes district heating.
- Local governments take few measures to encourage or ensure that customers hook up to district heating when it is installed, as in Sweden, with its strong tradition of government direction of private activity.
- Rates for electric and gas utilities may not fully reflect all the environmental costs of making energy available in these forms.

Some state utility commissions, as part of their powerplant siting oversight function, are now considering use of powerplant waste heat for district heating.[84] The President's National Energy Program encourages these efforts. For its part, the federal government proposes to use the large quantities of waste heat from its gaseous diffusion uranium enrichment plants for heating buildings onsite and for nearby households, industry, and agriculture.

Many institutional problems of solar heating and cooling involve building codes and other land use controls. Both present building codes and covenants in deeds may restrict use of solar systems. Sun rights may be a problem; the owner of a building heated by solar energy may not be able to stop construction of a neighboring building which blocks the sunlight. Rates for the electric backup that is infrequently needed for supplementing solar heat may be unfavorable.

For many forms of solar energy, the difficulty is cost. Here the prospects are reasonably encouraging. For example, although photovoltaic cells are very expensive for most applications, their costs have dropped by one-half in the past 2 years. Although in principle, operation of photovoltaic cells is relatively simple and should not require large expenditures for environmental health and safety controls, the cells do involve toxic substances and methods must be developed to ensure safe manufacture and disposal.

Incentives proposed in the National Energy Plan are intended to offset some of the high costs of solar heating and cooling equipment: a tax credit for property owners to decrease with time from 40 percent to 15 percent, a 10 percent tax credit for energy-saving investments by business to apply as well to solar equipment, and a 3-year federal program of up to $100 million for installing solar equipment in federal buildings.

The cost problem could also be approached by setting utility prices to reflect the full costs of generating electricity from conventional fossil fuels or nuclear energy. Electricity generated from coal, for example, is underpriced compared with solar electric energy unless it includes the full environmental costs of producing and burning the coal. Until all the costs of reclaiming strip mined land, safeguarding the health of miners, cleaning up the air, protecting water quality, and aiding and compensating small rural communities for adverse effects of a coal boom—until these and all other costs are fully reflected in the price of coal-generated electricity—solar electricity, with its relatively small environmental costs, is at a disadvantage.

In fact, some small- or intermediate-scale solar technologies fit energy needs in developing countries and are less costly than available alternatives.[85] Relatively simple systems producing electrical or mechanical energy to be used onsite would not involve the expense and delay of constructing distribution networks. Photovoltaic cells, windmills, and heat engines powered with solar collectors or fuels derived from plants or animal wastes could be effective and cost competitive where electricity from grids may cost as much as 45 cents per kilowatt hour in urban areas and electricity from diesel generator sets or batteries may cost $1 per kilowatt hour or more in rural areas. (Typical rates in the United States are 3 to 6 cents per kilowatt hour.)

Solar devices delivering moderate amounts of energy onsite are in use in many countries, especially in rural areas where firewood or human or animal labor can back up systems that operate intermittently from the sun's energy.[86] Because these systems are relatively labor intensive, they suit the needs of countries with high unemployment, and because they use the sun's energy, they are available to poor countries that lack other energy resources. In addition, they are relatively simple to build, operate, and repair. The costs of building locally controlled industries to manufacture and service solar devices may be a fraction of the costs of developing an indigenous nuclear power industry—and without the dangers of nuclear proliferation.

In this country, it may be economically feasible, now or very soon, to use solar devices for production of electrical or mechanical energy in remote places where conventional energy is very expensive. Such devices might reasonably be used in fire towers, navigational buoys, remote irrigation pumps and telephone systems, and specialized defense needs. Although these uses may be limited, the potential market is not inconsequential. For example, the Department of Defense has estimated that if the early 1977 price of solar cells were to drop by one-half (a likely reduction), DOD could purchase $100 million worth without subsidy each year.[87] Federal purchasing policies could contribute to a thriving solar energy industry, leading to further development of this renewable resource.

Solar and many other nonconventional technologies were long at a disadvantage for federal research funds. Nuclear R&D had received $5.2 billion between 1954 and 1975 and solar energy only an estimated $0.07 billion. As shown in Table 19, the 1978 budget allocates $368 million to solar R&D (compared to $100,000 in 1970) and $1,666 million to nuclear energy—$1,233 million for light water reactors and advanced concepts and $433 million for fusion.[88] Research in a variety of technologies spreads the risk and reduces the possibility of a major gap in future energy development because an "essential" technology fails. The President's National Energy Program supports these objectives.

It is not clear how we can meet future energy needs; nor indeed is it clear how much energy is needed to achieve the desired goals of economic growth, jobs, comfort, and quality of life. What does appear

Table 19

Federal Solar RD&D Budget, 1970–78

Year	Budget authorizations (million dollars)
1970	0.1
1971	1.2
1972	1.7
1973	4
1974	15
1975	43
1976	115
1977	290
1978	368

Sources: Booz-Allen and Hamilton, Inc., "A Policy Assessment of Solar Heating and Cooling for Buildings—Draft," prepared for the Council on Environmental Quality, August 1977, and information supplied by R. Miller, Energy Research and Development Administration, 1977.

certain is a severe shortage of the traditional fuels on which our energy economy is based. Further, it behooves us to achieve a greater measure of efficiency and to use renewable energy resources before the conventional fuels are prohibitively scarce or high priced. The nonconventional energy technologies are developing at a revolutionary rate. A vigorous effort to reduce costs and speed technical development could bring about widespread use of these technologies within this century.

THE PROMISE OF MORE EFFICIENT TECHNOLOGIES

A number of technologies—either existing or being developed—could extend fossil fuel supplies or capture the sun's energy. Examples from the first group are cogeneration of steam and electric power, district heating, and total energy systems. The most promising solar technologies are solar space and hot water heating, small-scale hydroelectric generation, wind turbines, and solar electric plants using either photovoltaic cells or mechanical means to raise high temperature steam.[89]

Efficient Fossil Fuel Systems

With the conventional thermal generating cycles used in most electric powerplants, only 30 to 40 percent of the energy is converted into useful electrical energy. The other 60 to 70 percent is dissipated into the air or into the water used for cooling. In 1976 waste heat arising directly from electric power production amounted to some 14 quadrillion British thermal units—approximately 18 percent of the gross energy consumption in the United States.[90]

Better use of this generally neglected resource is expected to play a critical role in our future energy supply.[91] Of a number of possibilities, more important uses are cogeneration of steam and electricity for industry, district heating, and total energy systems, all reasonably well developed and extensively used in other countries.

Cogeneration Combining generation of electricity with production of industrial steam could substantially improve energy use efficiency. Not only could cogeneration cut fuel use and associated air pollution, but it could help reduce capital expenditures.[92]

There are generally two types of cogeneration facilities in use in the United States. The first supplies steam from large central power stations to nearby industrial sites. Several of these central "dual-purpose" powerplants are operating; in addition, some site-specific feasibility studies are being conducted.[93]

Although the benefits are significant, applicability is limited because industrial needs do not necessarily match those of existing or proposed large-scale powerplants. The utility must find a nearby industrial plant with steam requirements equal to the output of large operating units. For the utility's added investment to be worthwhile, the industrial plant must also have a regular load schedule and operation and good prospects for long-term survival.

A second arrangement is to generate industrial steam and power from small decentralized powerplants located at industrial sites. Small-scale cogeneration of this kind is commonly used in the papermaking, oil refining, and chemical industries. The steam and much if not all the electricity are used directly in the plant. Any leftover electricity is supplied to the utility grid.

Cogeneration facilities in West Germany supply some 12 percent of the nation's electricity.[94] Here they accounted for less than 5 percent of the electricity generated in 1975.[95] In fact, the importance of industrial cogeneration has been declining in this country for several decades, apparently because bulk industrial electricity is cheap. Even with the recent price increases, industrial cogeneration may not assume much importance in the near future. The chief impediments are institutional, as discussed above. Assuming that they are overcome, cogeneration could potentially save about 6.7 quadrillion Btu's—more than 3 million barrels of oil equivalent per day by the year 2000.[96]

District Heating In district heating systems, hot water or steam is conveyed by a network of underground insulated pipes from a central plant.[97] The piping network may be either a single once-through system or a double closed loop arrangement, which returns cooled water or condensed steam to the central station to be reheated. Figure 58 is a cross section of a typical street culvert and home installation. Heat comes from direct burning of a fuel or in a more energy-efficient form from waste heat released in generating electricity—another form of cogeneration.

Because the economy of a district heating system is a function of size, planning the entire system, including expansions, is essential. Using a step-by-step approach, district heating systems can be rapidly built up.[98] Mature district heating systems have been built in Sweden in 5 to 10 years.

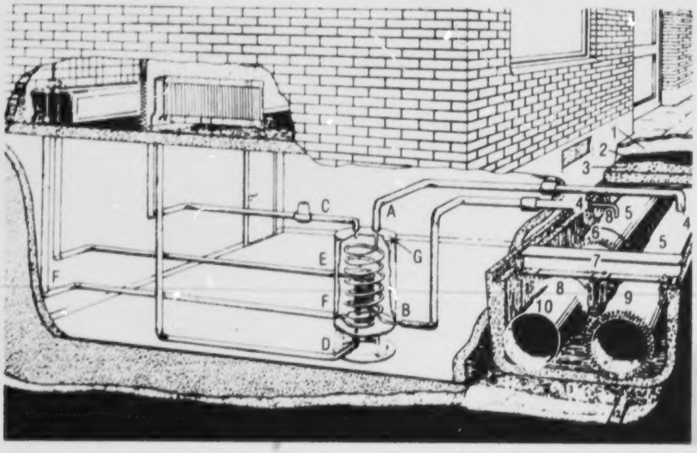
District heating can significantly reduce the air pollution from heating homes, offices, and stores because it is more efficient and uses less fuel overall than individual units. In addition, the combustion unit can be more carefully maintained in order to limit excess pollution. Flue gas treatment is also more economical in large central plants than in individual units. The environmental benefits from district heating have been demonstrated in other countries.[99]

Use of district heating in the United States has been declining, although several European countries—with higher energy prices, strong government encouragement, and extensive reconstruction following World War II—have used it widely. For example, 20 to 25 percent of the people in Sweden use district heating systems, and in the next 10 years, the Swedes expect a 10 percent increase. District heating is also common in Denmark and West Germany and

310

Figure 58

Section Through a Street Culvert, Malmö, Sweden



1. Gravel/sand layer.
2. Asphalt. Bitumen matting.
3. Concrete cover.
4. Service connection. Plastic culvert with mantle of PEH or PVC and insulation of mineral wool, polyurethane etc.
5. Mains.
6. Mineral wool insulation with plastic film over upper half.
7. Pipe support: Steel joist, pendulum and support ring.
8. Steel pipe.
9. Supply main: 80-120°C.
10. Return main: 50-70°C.
11. Prefabricated trough section of reinforced concrete.
12. Plastic drainage pipe.
13. Macadam.

A Supply main. Max. 120°C.
B Return main. Max. 80°C.
C Radiator system. Approx. 80°C.
D Radiator system. Approx. 60°C.
E Tap water. Max. 65°C.
F Cold water. Approx. 5°C.
G Heat exchanger: diagramatic.

Source: Malmö, Sweden, Technical Authority, reproduced in Kjell Larsson, AB Atomenergi, "District Heating: Swedish Experience of an Energy Efficient Concept," presented at a seminar, The Swedish Approach to Current and Future Energy Issues, Washington, D.C., May 3, 1977, p. 13.

in Eastern Europe.[100] The United Kingdom is carefully studying the possibilities of this technology.[101]

European cities, which are generally compact and densely populated, are more suited to district heating than the sprawling metropolitan areas typical of the United States, although district heating appears feasible in those U.S. urban areas with high population densities. It may be economically and politically feasible only if installed when new sections or subdivisions are constructed.

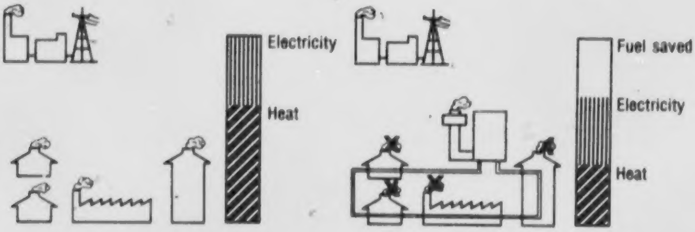
Use of waste heat from electric powerplants is the most efficient, economical, and common form of district heating. Obviously, using the waste from the generation of electricity is more efficient than burning fuel in another system for home heat. Figure 59 shows that when district heating uses electric powerplants, the total energy used is only about one-half that of the systems separately.

Total Energy Systems In a total energy system, electric power for a small complex of buildings is generated locally and the reject heat used for the buildings' heating, cooling, and hot water supply.[102] Typical applications are shopping centers, hospitals, high rise office buildings, and dormitories. Efficiencies between 65 and 85 percent are achievable.[103]

The systems must be carefully designed to match electrical needs with needs for hot water and space heating and cooling. Best design may require thermal storage systems. Total energy systems cost more initially than conventional systems, and the higher first costs, added to responsibility for operation and maintenance and historically declining costs for commercial power, have discouraged widespread

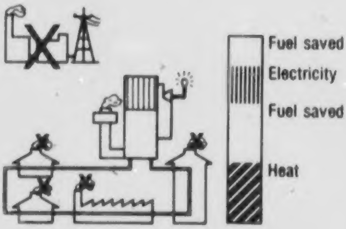
Figure 59

Heat and Electricity Production Comparisons



Households, flats, industries

District heating hot water boiler plant



Combined production

Source: Malmö, Sweden, Technical Authority, reproduced in Kjell Larsson, AB Atomenergi, "District Heating: Sweden Experience of an Energy Efficient Concept," presented at a seminar, The Swedish Approach to Current and Future Energy Issues, Washington, D.C., May 3, 1977, p. 4.

use. With electric costs now rising, total energy systems may become more widely used.

Air pollution and excessive noise from the diesels and turbines used to generate electricity may be a problem. Nitrogen oxides and particulates from diesels may be difficult to control.

Technologies Based on Renewable Energy

Small-Scale Hydropower Small hydropower projects are not new, but like many another formerly uneconomic technology, they are now attracting renewed interest because of the high price of oil and other fuels.[104] Many of them may prove to be an economic and environmentally desirable source of electricity.

Untapped hydropower potential in small 3 to 5 megawatt electric sites has recently been estimated at more than 14,000 megawatts electric (Mwe).[105] Dams already exist at some of the sites; all that is needed is electric generating facilities. Capital cost estimates per installed kilowatt range from $300 to $1,200, depending on location and on whether dams and other facilities already exist.[106] In New England, for example, 112 hydrosites have been abandoned since 1941 because other sources of power were more economic, but many are again economically feasible.[107] In addition to this potential, 14,000 megawatts electric is available in unfilled generation bays at existing (over 5 megawatts electric) damsites.[108]

At existing small damsites, adding generators is expected to cause only minor environmental changes. Dissolved oxygen levels may decrease slightly, and there may be some stagnation problems with changes in river flow patterns; even where new dams are required, environmental impacts at some sites should be relatively small. At large sites where dams exist but there are unused generation bays, the environmental damage has already been done and adding generators will change little. In the course of obtaining new licenses for additions, further controls to protect the environment may be required.

Recently a few utilities expressed some interest in small hydropower projects, offering to buy electricity from dam owners at rates that approximate the cost of fuel to utilities.[109] Deliberate efforts in accord with the National Energy Plan could lead to greater use of our small hydropower resources.

Wind Machines Use of windpower has a long history in the U.S. countryside, but with the coming of rural electrification cooperatives its use for generating electricity declined sharply.

The random, intermittent character of wind causes problems in integrating the power output into electric grids, requiring the use of specialized equipment. There are economic as well as technical problems in dealing with substantial amounts of uncertain supply, and solutions will involve making wind turbines part of a total system rather than relying upon them as a single source of power. Besides generating electricity, wind is well suited to work that is interruptible—irrigation, crop drying, and feed grinding, for example.

With potential windpower in the United States (within 500 feet of ground) estimated at a considerable 400 quadrillion Btu's per year,[110] it is worthwhile to examine available technologies.

Horizontal-axis rotors include both the familiar types—the old-fashioned farm windmills of the western prairies and the familiar mill of the Netherlands—and the modern windmills designed primarily for maximum efficiency in generating electricity. Two or three variable pitch blades are connected to an electric generator supported by a tower whose height is approximately the diameter of the rotor. These windmills range in size and output. One rated at about 100 kilowatts (that is, enough to power 1,000 100-watt light bulbs) is being tested by ERDA; others of 1.5 megawatts (large enough to supply the needs of a small community) are being designed.

The tower must be designed to accept the weight and much of the stress at the top and to avoid structural resonance with the spinning blades. With increasing size, design and materials problems related to stress and vibration become more serious, suggesting that there are limits to the advantages of large-scale systems.

The vertical axis wind machine is simpler because its generator is at ground level rather than atop a high tower and because it does not need to be turned into the wind. This kind of wind machine is more desirable in regions where wind speed and direction are highly variable but is less efficient than the horizontal-axis machine when wind directions are fairly uniform.

Experience with vertical axis machines is limited, but several designs appear promising, including one 200 kilowatt system which is to provide electricity to a Canadian utility late in 1977.

The economics of wind systems would be further advanced if low-cost energy storage systems become available. Research efforts to develop such storage systems are important to development of this resource.[111]

Photovoltaic Cells The resource base of solar energy is vast. Energy from sunlight reaching the earth exceeds world energy consumption by more than 15,000 times.[112] But like windpower, solar energy is somewhat random and intermittent and will be more widely useful when better storage systems are available.

Because the source of the energy is diffuse, large land areas are needed to collect it. For example, the arrays for a centralized photovoltaic generating plant will require 2 to 5 square miles for a 1,000 megawatt electric peak output plant[113] and several times this area for a baseload plant with an average power output of 1,000 megawatts electric. To put this in perspective, we should recall that coal for a 1,000 megawatt electric plant operating at 60 percent capacity over its 30-year lifetime would require strip mining of 2 square miles if located in the West and approximately 14 square miles in the East.[114]

Photovoltaic cells convert solar radiation into direct current through use of a semiconductive material at efficiencies of 8 to 15 percent; the cells are now commercially available. To connect photovoltaic cells to electric utility grids, we must convert direct current to alternating current of the matching phase.

There are no moving parts in photovoltaic cells, so that friction wear is not a problem, and the basic structure of the materials that generate electricity does not change with time. Photovoltaic cells are suitable for almost any size installation and any location, and they may be constructed from a variety of materials. Thus they are very flexible. But despite recent cost decreases, most photovoltaic cells are still extremely expensive, and the federal government is supporting research to decrease costs.

Solar Thermal Electric Conversion Another way to generate power from the sun is to create thermal energy to power turbines that drive electric generators. Several systems are under development but most of the research effort is concentrated on the power tower. The power tower uses hundreds of large steerable mirrors which focus the sun's rays continuously onto a large boiler that is 100 to 600 meters above the ground.[11] The boiler is to generate steam for a conventional steam turbine.

Plant size is planned for the 100 megawatt electric range, requiring about 1 square mile of land.[116] For example, it has been estimated that in the Southwest, the sunniest part of the country, the system would take roughly 5,000 square miles to meet the nation's present electrical demands. Costs are estimated at $2,000 per peak kilowatt for a plant with an average output of 50 percent of peak. This cost is several times that of conventional plants today, but if costs were no higher than this estimate by the end of the century, the power tower would be economically competitive with projected costs of coal and nuclear units at that time. ERDA is funding construction of a 10 megawatt plant in California; testing is scheduled to begin in 1980.

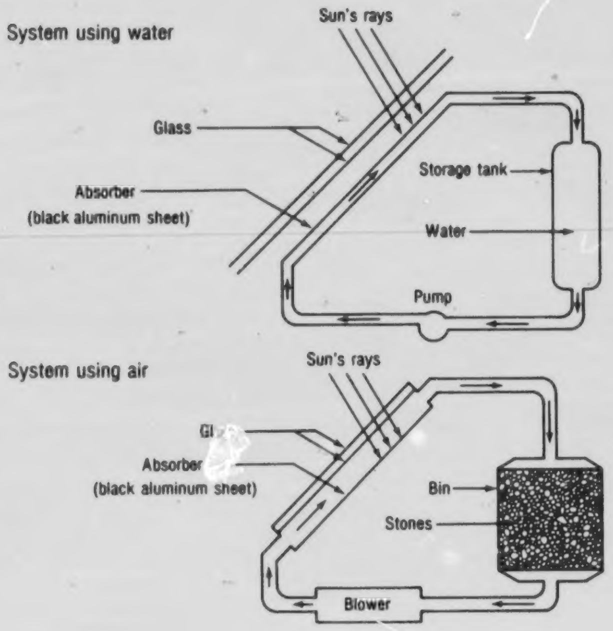
The principal environmental impacts of such plants would be on the desert areas where they are built. Changes in vegetation and wildlife are expected, but specific environmental impacts remain to be determined.

Solar Heating and Cooling Among all the possible applications of solar energy, heating is the most advanced and most nearly economic today.[117] Marketable uses at present are water and space heating in buildings. Water heating is the more cost competitive of the two for both homes and industry and can often meet one-half to three-fourths of a family's hot water needs economically.

Designs for space heating systems are proliferating, but a trend toward technical simplicity is evident. Three kinds of heating technology are being refined, the most advanced of which is the "active" system that uses solar energy collectors, a circulating heat transfer fluid, and thermal energy storage. It is shown in Figure 60. Most systems use water or an antifreeze solution as the collection fluid,

Figure 60

Active Solar Space Heating Systems


System using water
Sun's rays
Glass
Absorber
(black aluminum sheet)
Storage tank
Water
Pump
System using air
Sun's rays
Glass
Absorber
(black aluminum sheet)
Bin
Stones
Blower

The flow of water or stream of air carries the heat from the solar-radiation collector to the storage system (a water-filled tank or a bin filled with stones) or delivers it directly by conventional means (radiators or forced hot air) to rooms of the house.

Source: William A. Shurcliff, "Active-Type Solar Heating Systems for Houses: A Technology in Ferment," *Bulletin of the Atomic Scientists* 32(2):32 (1976).

although some are now using circulating air. "Passive" space heating systems use highly energy efficient architectural designs that minimize the need for conventional fuels. A third system, with technical merit, is the solar-assisted heat pump.

Direct solar energy cooling systems work on a variety of principles, of which high-temperature absorption appears most promising.

With solar hot water systems, which compete favorably with conventional electric systems in many areas, full return of the original investment is possible within as little as 10 years. Space heating systems pay off more slowly but in favorable localities can compete with electric resistance heating on a life cycle costing basis. With present energy prices, space cooling is not competitive.

Solar systems have high capital costs and low operating costs. The combined costs of owning and operating—life cycle costs—should be used to measure economic feasibility. Among the many local variables that determine feasibility, three are key: available solar radiation, thermal load of the building, and prices of alternative fuels, taking into account future prices.

Purchase prices for single family units now range from $1,000 to $2,000 for a domestic hot water system; $4,000 to $10,000 for a combined hot water and space heating system; and $10,000 to $20,000 for a combined hot water, space heating, and space cooling system.[118] Prices may not drop dramatically in the future, but they may become more attractive as conventional fuel prices rise.

Widespread installation of solar heating and cooling systems will bring about a number of positive environmental effects: reduced demands for fossil and nuclear fuels at electric powerplants and therefore less mining and extraction of these materials, less solid waste and thermal pollution, and less pollution from oil refining. The negative environmental impacts are small, and most are not unique to solar systems but result from construction, chemical waste treatment, and manufacturing activities.

Biomass Energy Because the sun's energy is converted and stored in plants, it is possible to use solar energy indirectly through fuels derived from organic materials.[119] Drawing stored solar energy from this biomass avoids the chief problems of direct, immediate use of sunlight which arise from its intermittent and diffuse nature.

Through photosynthesis, green plants form organic materials out of sunlight, water, carbon dioxide, and nutrients. Only a small fraction of the solar energy reaching the earth is converted by plants to chemical energy—on the order of 1 percent or less. Yet plants store 20 times as much energy as the entire world uses each year.[120]

Even here in the United States, where per capita energy use is very high, photosynthesis production in plants that grow on land is comparable to national energy consumption. Because much of this biomass is used and most of the remainder cannot be recovered economically, only 10 percent of the plant material is readily available for energy conversion, and further losses occur during conversion. Potential sources for biomass energy from both terrestrial and aquatic plants include food processing wastes, crop remains, animal wastes, forestry wastes, and the produce of energy plantations on land or sea—trees, corn, kelp, water hyacinths, and so on. Altogether renewable fuels derived from readily available biomass may be able to supply about 5 percent of the present U.S. energy demand.[121]

The oldest and most ubiquitous of fuels, wood, is a biomass resource which is burned directly in its original form. Biomass resources are also converted into solids, liquids, and gases. Anaerobic fermentation or biogasification can produce methane (similar to natural gas of pipeline quality) from most biological materials other than wood.[122] In its most elementary form, the equipment is simply a tank or digester in which anaerobic bacteria feed on the organic material and produce methane, carbon dioxide, trace gases, and nutrient-rich sludge which is suitable for fertilizer. Although the principle of biogasification is simple, the biological processes themselves are complex, and many technical and economic improvements are needed.

Biological processes also produce liquid fuels.[123] During World War II alcohol and hydrogen were produced by fermentation to supplement conventional fuels. Use of alcohol derived from biomass as a substitute for gasoline is now under serious investigation in Brazil.[124] Research is needed on better conversion by microorganisms and on improved equipment for fermentation and recovery.

Pyrolysis, another important process for converting biomass into different forms and fuels, works by heating organic material in an oxygen-deficient atmosphere. The output is a solid fuel (char), a tarry liquid fuel, methanol, a gaseous fuel composed primarily of carbon monoxide and hydrogen, or a mixture of the above. [125]

Material for energy production may be obtained by collecting organic wastes. Although the energy potential contained in the wastes is large, collecting some of them would incur inordinate expense. Others, like stockyard wastes, are readily collectible. Alternatively, we could deliberately produce plant material on a large scale for use as a biomass resource—in other words, an energy plantation. The concept has distinctly limiting factors; land availability, water, and nutrient supply are major ones. Environmental problems may include increased soil erosion and atmospheric dust, additional demands for limited water resources, and the destruction of natural habitat.

Forests of several hundred square miles could supply fuel for a large wood-fired electric powerplant with no major technical problems.[126] But in the United States, land areas with high photosynthetic yields are generally more valuable for other uses.

Ocean farming—mariculture—does not share the constraints of land and water availability. Conceivably, it could expand biomass production enormously.[127] Floating kelp farms have been studied. With kelp attached to a grid of lines to maintain spacing and prevent storm damage, biomass yields could be several times higher than on land. The kelp harvest could then be used as feedstock for biogasification. The promise of such mariculture projects is great, but understanding is limited and technical and commercial feasibility has not been established.

Insofar as biomass can replace conventional fuels, the well-known environmental problems of fossil and nuclear energy will be diminished. Further, if large quantities of such organic materials as livestock manure and food processing wastes were converted to energy production, pollution from improper disposal would be reduced.

Besides the immediate benefit, the use of biomass fuels, indeed, the use of any form of solar energy in a steady state system, would lessen the long-term worldwide buildup of atmospheric carbon dioxide. In a steady state system, CO_2 would be used for photosynthesis at the same rate it would be produced in combustion. (See the earlier air quality section in this chapter for discussion of carbon dioxide buildup.)

NONRENEWABLE RESOURCES

Advances in living standards, particularly in the 20th century, have rested upon the availability and exploitation of natural resources. But their consumption by the developed world has grown so rapidly that concerns are being voiced about nature's bounty running out, especially as developing countries attempt to match the living standards of the developed world.

Natural resources may be classified as renewable or nonrenewable. As shown in Figure 61, over 93 percent by weight of the raw materials that we use are nonrenewable. Some renewable materials are far more significant than their small percentages suggest, and they may well replace those which are becoming scarce, are exceptionally energy consuming, or are imports. For example, in construction, lumber may substitute in part for steel, aluminum, and masonry, each of which requires large amounts of energy to produce, and biomass may supplement fossil fuels in the production of energy.

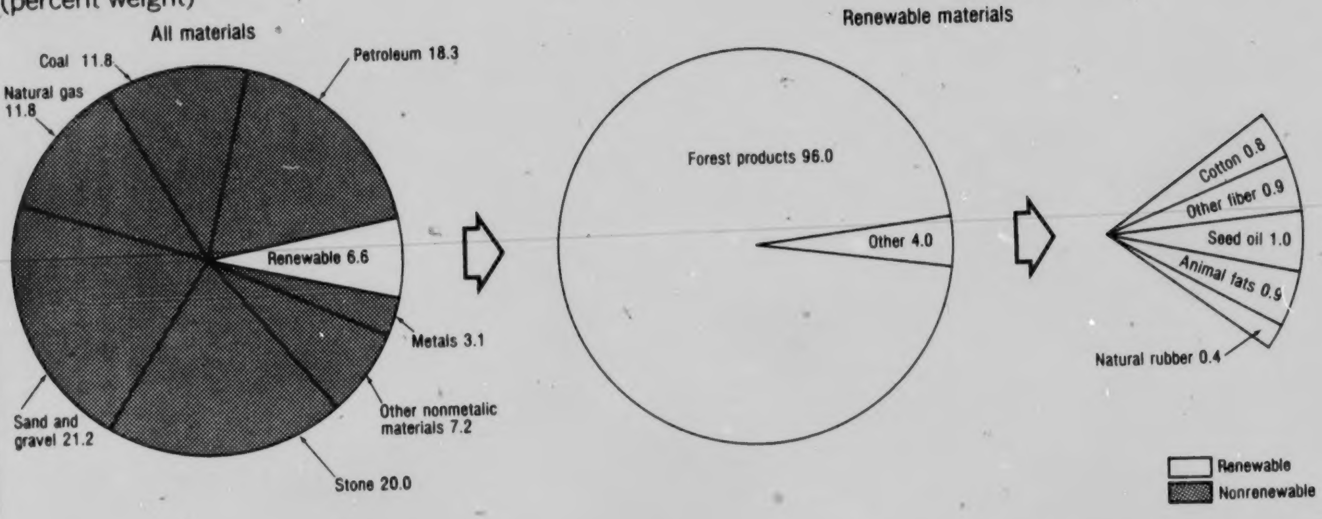
Nonrenewable resources are fossil fuels, basic minerals from which metals and many industrial products are produced, materials such as sand, gravel, stone, and clay, and such elements as gold and helium. These resources may occur widely, but only when their presence is known and we are reasonably sure that they can be recovered under existing economic and operating conditions are they termed "reserves." "Resources" is a broader term which includes:

- Reserves
- Identified subeconomic deposits, known to exist but too costly to exploit with present recovery technology and market prices
- Hypothetical resources, not yet discovered but geologically predictable in known mineral districts
- Speculative resources, assumed to exist in unknown mineral districts on the basis of broad geologic similarities or statistical relationship with known mineral districts.

If exploration in the hypothetical or speculative categories uncovers deposits, they become either reserves or identified subeconomic deposits, depending upon how readily they can be exploited. Reserves increase if the price of the resource rises or if technological improvements lower recovery costs. Reserves, then, are constantly changing because of depletion through use, replenishment through discoveries, changing prices, and changing recovery costs. There is no way to predict any of these factors, but as resources are used over the long run, a decline in their availability is ultimately inescapable. As we use up available supplies of a resource, other resources are

Figure 61

U.S. Basic Raw Material Use
(percent weight)



Source: National Research Council, Board on Agriculture and Renewable Resources, *Renewable Resources for Industrial Materials* (Washington, D.C.: National Academy of Sciences, 1977), Figure 1, p. 38.

substituted. For example, as domestic supplies of gas have declined in recent years, attention has shifted to coal, nuclear power, and solar and other sources of energy. Coal is now slowly regaining the position that it lost with the advent of petroleum and natural gas. Because coal is expensive to transport, is less convenient to use, and is still a cause of pollution, efforts are underway to convert it to gaseous and liquid fuels. Substituting for natural gas and petroleum products, the liquid fuels could be transported by pipeline.

ENERGY IMPLICATIONS

Fuel supplies are receiving critical attention, for example, construction of the Alyeska pipeline designed to transport 2 million barrels of oil per day, opening of new outer continental shelf areas to oil and gas development, and programs for coal- and oil-shale leasing. Fuel is important not only for direct use in heating, cooling, transportation, and so on but also in processing other minerals and materials. The materials industries use more than one-fifth of the nation's energy; metals processing uses 8 percent, chemical and allied products 7.8 percent, petroleum refining 4 percent, and nonmetallics 2 percent.[128]

Minerals and other materials are essential to development of new energy sources. The U.S. Geological Survey has estimated nonfuel mineral requirements for increasing domestic energy production to a level of self-sufficiency in the United States (see Table 20). Heavy demands may be made for aluminum, barite, bentonite, indium, iron, and tungsten, with significant demands for copper, fluorite, magnesia, manganese, molybdenum, and silicon.

The United States has no reserves with which to meet such demands for manganese or even the modest demands for chromium, cobalt and niobium. Imports supplemented by industry inventories and by sales from government stockpiles fill the needs for these metals. Imports also provide substantial proportions—from 30 to 85 percent—of such materials as aluminum, antimony, asbestos, barite, fluorite, nickel, silver, tin, titanium, tungsten, zinc, and zirconium, all of which are critical to the production of energy.[129]

The amount of energy needed to produce the materials for energy development during the 15 years from 1975 to 1990 is the equivalent of 2.5 billion barrels of oil. For production of materials for all uses, the total is approximately 18 billion barrels—the equivalent of more than one-half the known U.S. recoverable petroleum reserves.[130]

Use of lower grade ores as the richer ores are depleted increases energy consumption markedly. Increased mechanization, although generally lowering processing costs, increases energy demands. Mineral production rose 50 percent in the last 50 years, but in the last 25 years energy consumption in mineral production rose 600 percent.[131] For some materials the increasing amounts of energy required to

Table 20

Estimated Minimum Nonfuel Mineral Requirements for Energy Production in the United States, 1975–90

(metric tonnes)[1]

Material	Energy industry total demand	Energy industry demand as a percent of all industry
Aluminum	18,400,000	10.7
Antimony	1,070	0.1
Asbestos	147,000	1.0
Barite	29,200,000	107.0
Bentonite	12,700,000	23.3
Boron	41	0.0
Cadmium	130	0.1
Chromium	264,000	2.5
Cobalt	1,760	1.1
Concrete	348,000,000	4.0
Copper	4,690,000	9.0
Fluorite[2]	1,980,000	7.1
Indium	145	23.7
Iron	213,000,000	13.0
Lead	25,300	0.1
Magnesia[2]	1,310,000	8.4
Manganese	2,080,000	8.0
Mica	5,410	0.2
Molybdenum	78,800	9.5
Nickel	264,000	5.9
Niobium	933	1.3
Silicon[2]	815,000	7.0
Silver	1,120	0.9
Tin	1,540	0.1
Titanium	7,020	0.1
Tungsten	40,100	18.6
Vanadium	3,810	2.0
Zinc	3,260	.01
Zirconium	27,500	1.8

[1] One tonne=2,204 lbs.

[2] For each tonne of steel, 4 kgs. (9 lbs.) of fluorite, 3.2 kgs. (7 lbs.) of magnesia, and 2.5 kgs. (5.5 lbs.) of silicon required in steel manufacture have been included in the totals. For each tonne of aluminum, 60 kgs. (132 lbs.) of fluorite and 15 kgs. (33 lbs.) of silicon have been included.

Source: John P. Albers, Walter J. Bawiec, and Lawrence F. Rooney, *Demand and Supply of Nonfuel Minerals and Materials for the United States Energy Industry, 1975–90—A Preliminary Report* (Washington, D.C.: Government Printing Office, 1976), Geological Survey Professional Paper 1006-A, B, Table 3, p. B3; percent based on Table 2, p. B4.

process lower grade ores may become so costly as to restrict production substantially.[132]

Assuming that environmental safeguards and technical developments will make it practical for coal and other energy resources to replace dwindling supplies of petroleum and natural gas, world supplies of nearly all minerals and materials now in use should suffice to meet projected needs through the year 2000 and well beyond.[133] Replacements for minerals and materials that do become scarce are expected to be available, and shortages caused by exhaustion of resources are not likely considering prospects for substitution, recycling, new discoveries, and developments using the lower grade materials.

OTHER RESTRICTIONS ON AVAILABILITY

Other factors influence availability and continuity of materials supplies. For example, environmental considerations may run counter to increased production. With shifts to lower grade ores, more tailings are left, more land is disrupted, and more fuel—with its associated pollution—is consumed. Environmental stress per unit of materials production is likely to increase, causing tensions between material availability and environmental quality.[134]

Although world supplies of particular resources are ample, availability to all who want them is not guaranteed.[135] Demand for materials may be uneven and unrelated to their location, setting the stage for international trade barriers. Increased confrontation between resource-rich and resource-lean nations and obstacles to international investment (which provide poorer nations the funds required to expand resource production) could reduce resource availability and increase mineral costs.

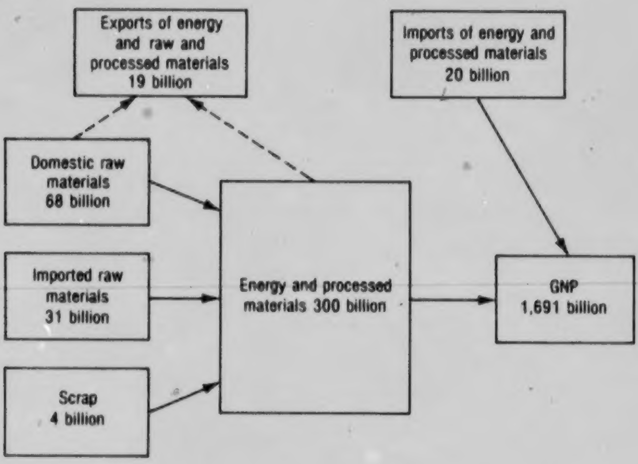
At least 12 Third World countries nationalized copper, bauxite (aluminum ore), tin, and iron mines during 1974 and 1975. Since then Venezuela has nationalized mines supplying 15 million tons of iron ore annually, an amount equal to 30 percent of U.S. imports. Many other countries have declared a similar intent to control their natural resources. Such actions discourage foreign investments[136]—indeed, foreign investments in minerals development have dropped steadily from a peak of $9.4 billion in 1971 to $4.2 billion in 1975, and only $3.6 billion was expected for 1976.[137]

Emulating the success of the Organization of Petroleum Exporting Countries, foreign producers have formed associations to influence the marketing of the minerals which they supply,[138] but it appears unlikely that their efforts will result in OPEC-like monopolies because stockpiling, technological advances, and substitute materials make the United States less vulnerable to manipulation. Yet access to resources of other nations is gradually changing at a time when our mineral resources are becoming increasingly difficult and costly to find and to produce.

The role of domestic and foreign nonrenewable minerals in the U.S. economy is complex, considering both imports and exports of raw and processed materials. This relationship is shown in Figure 62. Total U.S. use of new mineral supplies in 1975 was approximately 4 billion tons, about 20 tons per person.[139] Per capita consumption has apparently leveled off in the last 25 years; in 1952 it was 18 tons. In the heavily populated developing countries, which also have high population growth rates, the increase in materials consumption,

Figure 62

Mineral Materials in the U.S. Economy, 1976[1] (billion dollars)


Exports of energy and raw and processed materials 19 billion
Imports of energy and processed materials 20 billion
Domestic raw materials 68 billion
Imported raw materials 31 billion
Scrap 4 billion
Energy and processed materials 300 billion
GNP 1,691 billion

[1]Estimated values.

Source: U.S. Department of the Interior, Bureau of Mines, *Minerals Facts and Problems: 1975 Edition* (Washington, D.C.: Government Printing Office, 1975), Bulletin 667, Figure 11, p. 8.

though starting from a much lower base, has been quite rapid. For example, per capita steel consumption in India doubled between 1950 and 1970.[140]

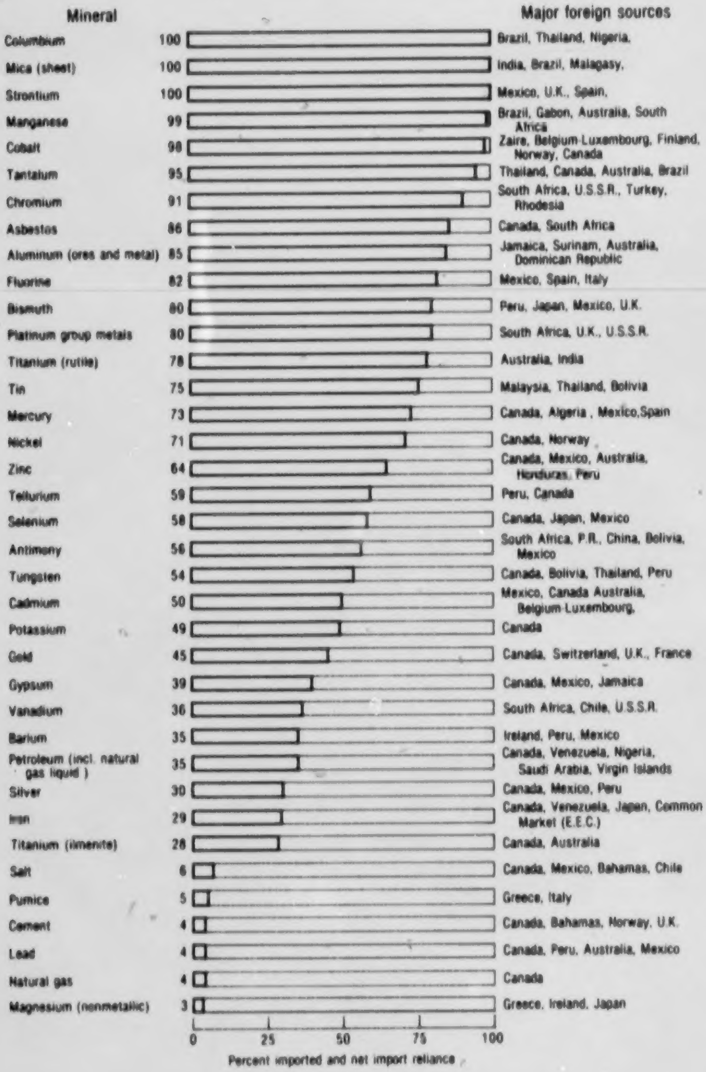
IMPORTS AND STOCKPILING

Although the world supply of minerals *is* sufficient to world demand to the year 2000, the domestic identified resource position of the United States is far from self-sufficient, especially when compared to recent estimates of cumulative demand for these minerals through the year 2000.[141] Many nonrenewable resources that are important in the U.S. economy are imported. The percentage imported and the major foreign sources are shown in Figure 63. It should be noted that Canada is one source of supply for 20 of these imports, Mexico for 13, Australia for 8, and South Africa for 6. Five must be obtained from the rest of the world, among them three very important resources, niobium, sheet mica, and tin.

The value of imports (approximately $40 billion) totals a little over twice the value of U.S. exports (approximately $18 billion).[142] Developing countries supplied only 5 percent of U.S. materials requirements in 1973 although some are relatively critical to security

Figure 63

Imports as a Percentage of Total U.S. Consumption, 1975[1]



[1] Apparent consumption = U.S. primary + secondary production + net import reliance.

[2] Net import reliance = imports − exports + government stockpile releases ± industry stock changes.

Source: U.S. Department of the Interior, Bureau of Mines, *Mineral Facts and Problems: 1975 Edition* (Washington, D.C.: Government Printing Office, 1975), Bulletin 667, Figure 16, p. 12.

or economic health.[143] Imports of fuel are a special case. The dollar value of imported fuel is more than that for all other minerals and materials combined.

Critical and strategic materials are stockpiled by the federal government to ensure an uninterrupted supply in the event of war. These stockpiles also offer some protection against curtailed imports and sudden increases in prices of key materials. For materials not available domestically and found only in limited geographic areas overseas, political decisions and stockpile considerations may be closely connected. One such material is chromium.

Chromium is widely used in the steel industry to enhance such properties as hardenability, impact strength, and resistance to corrosion, oxidation, and wear. Stainless steel cannot be made without it, and its replacement in some other alloy steels by such metals as nickel or cobalt is more costly and lowers performance standards.

Chromite, the sole commercial source of chromium, has not been mined in the United States since 1961. South Africa has the world's largest reserve of chromite; the second-largest reserve is in Rhodesia, totaling about 560 million tons or about one-third of the total world reserves. Rhodesia has the world's largest reserves of high quality chromite.[144] Together, South Africa and Rhodesia account for 96 percent of the world's chromite reserves and 95 percent of its identified resources.[145] The Soviet Union is the third largest potential source of chromite and is currently the world's leading producer. These three countries, along with Turkey and the Philippines, were the principal suppliers of chromium to the United States in 1975.

The chromium stockpile was critical to U.S. industry and national security during and after the Berlin blockade when U.S. imports from the Soviet Union were stopped for several years. Subsequent change in stockpile criteria created large stockpile excesses, and beginning in 1965, sale of these excesses became a factor in chromium supply.

In 1966, with the United States in agreement, the United Nations levied economic sanctions against Rhodesia, forbidding importation of Rhodesian chromium. Concerned about the size of the stockpile and possible dependence on the Soviet Union for supply of a strategic material, the Congress cancelled its support of the sanctions in 1971 and resumed import from Rhodesia. In 1975, Rhodesia supplied 11 percent of America's chromite imports and 26 percent of ferrochromium alloy imports.[146] In 1976, the figures were 3 percent for chromite and 20 percent for ferrochromium.[147]

Recent technological advances and increased production capacity in other exporting countries have lessened U.S. dependence on the leading chromium suppliers, and in March 1977 the Congress reversed its position and cut off further imports of Rhodesian chromium. Thus greater availability, coupled with the stockpile, enabled the United States to take political action that might otherwise have been difficult.

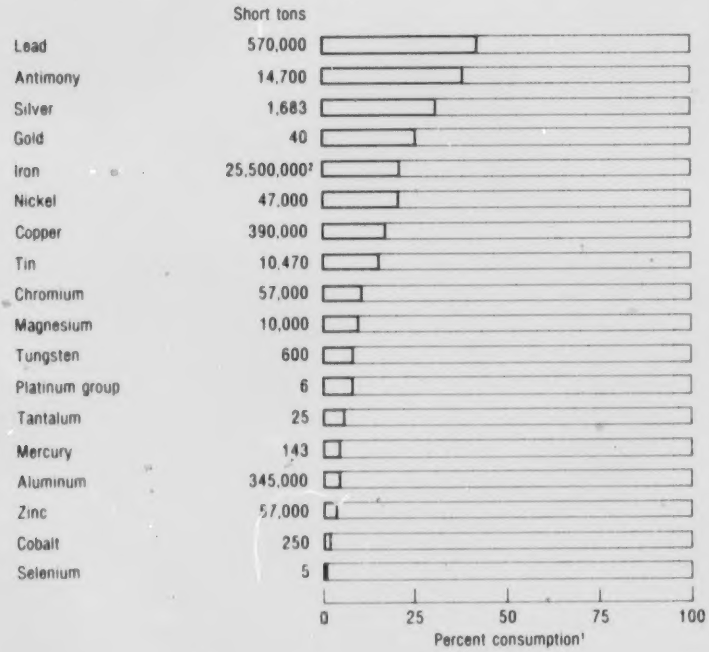
RECYCLING

Substantial portions of total U.S. supplies of several important metals, as shown in Figure 64, are derived from reclamation and recycling of old scrap, material which is largely recovered from junk. However, we consider most of the materials that we consume expendable and make no effort to recover and recycle them. Each year billions of tons of mineral wastes are discarded in the United States. Reuse of the metal and ceramic materials contained in these wastes would reduce demands upon reserves and conserve energy.

Recirculated or revert scrap is a significant form of iron and steel scrap. It is generated in manufacturing operations and is collected and recycled within the mill. Such scrap may recirculate several times, but statistics on its use are not generally available.

Figure 64

Old Scrap Reclaimed in the United States, 1976



[1] Apparent consumption = U.S. primary + secondary production + imports − exports + adjustments for government and industry stock changes.

[2] Includes exports.

Source: U.S. Department of the Interior, Bureau of Mines, *Mineral Facts and Problems: 1975 Edition* (Washington, D.C.: Government Printing Office, 1975), Bulletin 667, Figure 18, p. 13.

Revert scrap constitutes about one-half of all iron and steel scrap[148]; the other half is divided equally between prompt industrial scrap (returned to the steel mill 1 to 8 months after manufacture) and obsolete scrap (recycled from junked automobiles, building beams, rails, appliances, etc.).

POPULATION AND HUMAN SETTLEMENTS

POPULATION

U.S. Population Growth

The declining fertility rates and regional population shifts of the past few years continued through 1976, setting new records. The fertility rate dropped for the sixth consecutive year, reaching another record low, and for the first time since the first U.S. Census in 1790, the population of the South and West equaled that of the North—indeed, slightly exceeded it.

Population growth in the United States was 5.6 percent over the last 6 years and was 0.8 percent in 1976, with the number of people increasing to an estimated 216 million by January 1977.[149] This growth represents 3,165,000 births (1 percent higher than in 1975, despite the decline in fertility rate, because of the large number of women of childbearing age); 1,912,000 deaths (unchanged from 1975);[150] and the arrival of 310,000 legal immigrants. The net increase was 1,563,000 and the natural increase, minus immigration, was 1,253,000. Because of undercounting[151] and the presence of illegal aliens,[152] the population is probably on the order of 225 million.

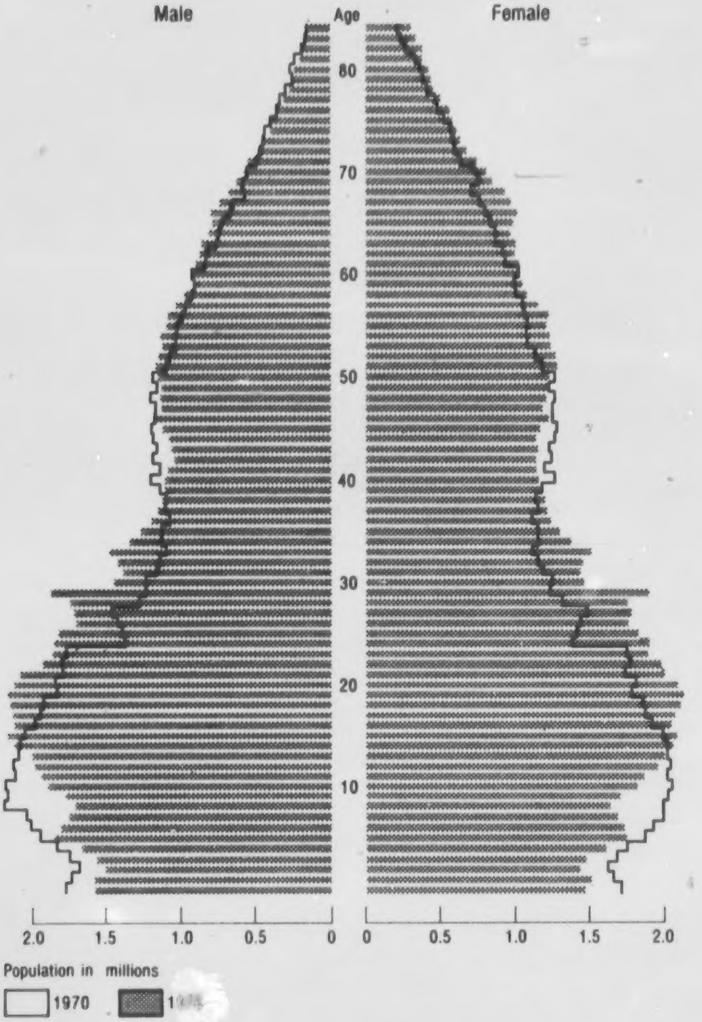
As a result of the last baby boom, youths between the ages of 15 and 29 now make up a considerably larger fraction of the population than those under 15 or between 30 and 44. The number of people less than 15 years old has continued to decrease since 1970. Distribution of the total population by age and sex is shown in Figure 65.

The total fertility rate dropped again in 1976 to 1.76 per woman, the lowest ever recorded for the United States, as shown in Table 21. Because there are now more women of childbearing age (15 to 44 years old) than ever before, births rose in 1976, but on a per capita basis, women continue to have fewer children (65.6 childen per 1,000 women of childbearing age compared to 66.7 for 1975).[153] The death rate has also been steadily declining, reaching a low of 8.9 per 1,000 people in 1976, about 1.1 percent lower than the 1975 rate.[154]

Despite the decline in the birth rate, population growth rates could accelerate because the number of women of childbearing age will increase from 47 to over 51 million between 1975 and 1980.[155] Even if the total fertility rate decreased to 1.7 and remained at this low level, the official population would approach 250 million people.

Figure 65

Population Distribution by Age and Sex, April 1, 1970 to July 1, 1976



Sources: U.S. Department of Commerce, Bureau of the Census, *1970 Census of Population: Characteristics of the Population, United States Summary* (Washington, D.C.: Government Printing Office, 1973), p. 1–265, based on U.S. Department of Commerce, Bureau of the Census, *Current Population Reports*, Series P-25, No. 643, "Estimates of the Population of the United States by Age, Sex, and Race, July 1, 1974 to 1976" (Washington, D.C.: Government Printing Office, 1977), pp. 3, 7, 16, and 19.

Table 21

Total Fertility Rate, 1920–75

(per thousand women)

Year	Rate	Period	Rate	Period	Rate
1976	[1] 1,760				
1975	1,799				
1974	1,857	1970–74	2,106	1940–44	2,523
1973	1,896	1965–69	2,636	1935–39	2,235
1972	2,022	1960–64	3,459	1930–34	2,376
1971	2,275	1955–59	3,690	1925–29	2,840
1970	2,480	1950–54	3,337	1920–24	3,248
1969	2,465	1945–49	2,985		

[1] Provisional estimate.

Source: For 1970–75 data: U.S. Department of Commerce, Bureau of the Census, *Current Population Reports*, Series P-20, No. 292, "Population Profile of the United States: 1976" (Washington, D.C.: Government Printing Office, 1976), p. 6; for 1976 data: information supplied by the Bureau of the Census.

A recent survey in upstate New York showed that two births in five are still unplanned.[156] If these statistics are representative, the present 3.1 million annual births would be one-half million less if all unwanted pregnancies were eliminated. Surveys taken during the sixties showed little change in planned pregnancies from earlier years, but in the seventies planned fertility declined significantly.[157]

Legal immigration now accounts for 25 percent of U.S. population growth—and eventually will account for all of it if fertility levels remain below replacement levels. Traditionally immigrants from Latin America, the Caribbean, and Canada were granted "special immigrant" status, which allowed them to enter more freely than immigrants from Asia, Africa, and most of Europe. Effective January 1, 1977, the special designation no longer applied, and immigrants from the Americas were subjected to quotas just as immigrants from other parts of the world were.[158] In February the President established a Cabinet-level committee on the rapidly increasing problem of illegal aliens, who now account for one-third or more of the U.S. population growth.

Population Distribution

People in the United States move frequently, but the rate has declined. Approximately 17.7 percent of the population now moves to a new address each year, compared to 20.1 percent between 1958 and 1961.[159] Increasingly, people are moving out of metropolitan areas, and they are continuing to move into the South and West from the northeast and north-central states.

Urban-Rural Movements Between March 1975 and March 1976, some 2.5 million people moved out of metropolitan areas and 2.1 million moved in. In the 5 years 1970–75, the population increased 6.3 percent in nonmetropolitan areas and only 3.6 percent in metropolitan areas, as seen in Table 22. In large part this migration is growth on the metropolitan fringes rather than a genuine movement back to the country. From 1970 through 1974, the population increased 9.1 percent in nonmetropolitan areas which are adjacent to metropolitan areas and from which 20 percent or more commute to a metropolitan area for work. In counties where less than 3 percent of the residents commute to metropolitan areas, the rate of population increase during the same period was 4.8 percent, as shown in Table 23.

Migration into rural counties appears to stem from various causes. "Rural" counties with a state university, a large portion of older or retired persons, or an especially attractive recreation area have experienced net immigration in recent years. In addition, employment in rural areas has increased faster than in metropolitan areas in every major industry except government. Energy development and mining are major factors.

But metropolitan areas are still growing, albeit more slowly than before, because of natural increase and immigration from abroad. This net growth continues in the suburbs, not the central city. Central cities experienced an outmigration of 4.61 million and a net loss of 1.96 million during the year ending March 1976, continuing the trend during the previous 5 years.[160] Relocations outward from the urban center outnumbered those moving in two to one.[161]

These shifts have economic implications. As people move out, the city's share of federal revenue based on population moves out with them. Further, the income of those moving in is generally lower than

Table 22

Population of the United States, 1950–75

(thousands)

Residential category	1975 [1]	1970	1960 [2]	1950	Percent change		
					1970–75	1960–70	1950–60
Metropolitan	141,993	137,058	119,595	94,579	3.6	16.6	26.4
Central city	60,902	62,876	59,947	53,696	−3.1	6.5	11.6
Suburban	81,091	74,182	59,647	40,883	9.3	26.7	45.9
Nonmetropolitan	66,690	62,761	60,384	56,656	6.3	6.8	6.4
Total	208,683	199,819	179,971	151,235	4.4	13.3	19.0

[1] The 1975 data are April-centered averages from the Current Population Survey; 1970 data are also from the Current Population Survey and have been adjusted by excluding inmates of institutions and members of the Armed Forces residing in barracks for comparability with 1975 data.

[2] Data for 1960 and 1950 are total population counts from the two respective decennial censuses. The total population counts for 1970 were used to calculate the 1960–70 percentage changes rather than the Current Population Survey figures shown.

Source: Brian J.L. Berry and Donald C. Dahmann, *Population Redistribution in the United States in the 1970's* (Washington, D.C.: National Academy of Sciences 1977).

Table 23

Growth of Nonmetropolitan Counties by Level of Commuting to Metropolitan Areas, 1960–74

Percent commuters [1]	Population			Percent change	
	1974	1970	1960	1970–74	1960–70
>19	4,372	4,009	3,655	9.1	9.7
10–19	9,912	9,349	8,705	6.0	7.4
3–9	14,261	13,497	12,805	5.7	5.4
<3	27,912	26,628	26,207	4.8	1.6

[1] Based on 1970 Census data for the percent of counties' work force commuting to a metropolitan area for employment.

Source: Brian J.L. Berry and Donald C. Dahmann, *Population Redistribution in the United States in the 1970's* (Washington, D.C.: National Academy of Sciences, 1977).

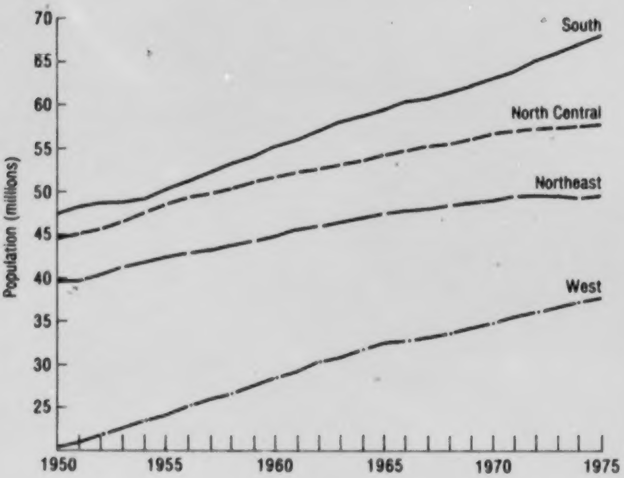
that of those moving out. Between 1970 and 1974, central cities experienced a net loss of $29.6 billion in the aggregate personal incomes of residents because of the differential income levels between inmigrants and outmigrants and the larger number of outmigrants. Central cities—with 29 percent of the nation's population—now contain 37.4 percent of the poor, an increase of 3.2 percent since 1970.[162]

The population growth in rural areas has slowed but has not stopped the decrease in the farm population. Between 1960 and 1970 the farm population declined at an annual rate of 4.8 percent; since 1970 the annual decline has been only 1.8 percent, and the number of people on farms reached 8.9 million in 1976.[163] Fewer than 1 in 25 now lives on a farm, compared to 1 in 4 in 1935. According to a recent study, U.S. agricultural policy has exacted a harsh toll on small farms in the South, particularly those owned by blacks.[164] The study maintains that large-scale farming is encouraged by private and public policy as efficient, but this concept of efficiency neglects the costs of lost taxes, energy consumption, and environmental damage and the added costs of dealing with the problems of a displaced population. Credit is often not available to small-scale marginal farms, and technical services, tax policies, and marketing trends favor large farms. Thousands of small farmers, finding themselves at a severe competitive disadvantage, have left their farms for urban areas, often unprepared by education, training, or experience for nonfarm jobs.

Regional Changes In 1976, for the first time, a majority of our population was located in the South and the West. Between 1970 and 1976, the northeast and north-central states experienced a net outmigration of population. During this time the South grew 9.6 percent and the West 10.7 percent, compared to 0.9 percent for the northeast and 2.0 percent for the north-central states, as shown in Figure 66.[165] This movement is partially explained by the attraction of warmer climates, the rise in energy costs, and the interregional cost

Figure 66

Population of the United States by Region, 1950–75



Sources: U.S. Department of Commerce, Bureau of the Census, *Current Population Reports*, Series P-25, No. 640, "Estimates of the Population of States with Components of Change: 1970 to 1975" (Washington, D.C.: Government Printing Office, 1976), p. 21; Series P-25, No. 304, "1950 to 1960" (1965), p. 10; and Series P-25, No. 460, "Preliminary Intercental Estimates of States and Components of Population Change, 1960 to 1970" (1971), p. 8.

of living differences. Regional operating and labor cost differences have also contributed to the relocation of firms in the South and West. These interregional population trends are indicated in Figure 67.

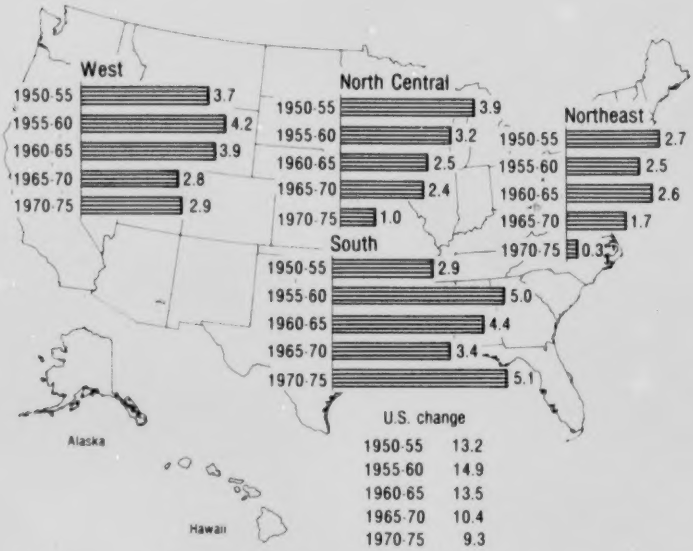
The Rocky Mountain states, with an average annual growth rate of 3.1 percent, more than 3 times the national average, illustrate this new pattern of regional redistribution, as shown in Figure 68. Other states—California is the most populous and Alaska the fastest growing—emphasize this change when compared with New York's stabilizing population and the population loss of such major cities as Chicago, Detroit, and Pittsburgh.

World Population Growth

World population exceeded 4 billion in March 1976, having added the last billion in 15 years. The next 1 billion is expected in about 13 years.[166] The average annual rate of world population growth for 1950–55 was 1.7 percent, for 1955–60 and 1960–65, 1.9 percent, and for 1967–70 and 1970–75, 1.8 percent.[167] Population growth rates of the last 25 years, by continent and by more and less developed regions, are shown in Figure 69. Figure 70 shows birth, death, and

Figure 67

Population Change by Region, 1950–75[1]



[1]Periods beginning July 1, in millions.

Source: U.S. Department of Commerce, Bureau of the Census, *Current Population Reports*, Series P-25, No. 640, "Estimates of the Population of States with Components of Change: 1970 to 1975" (Washington, D.C.: Government Printing Office, 1976), cover 1.

natural increase rates by continent. World growth since 1950 is given in Figure 71.

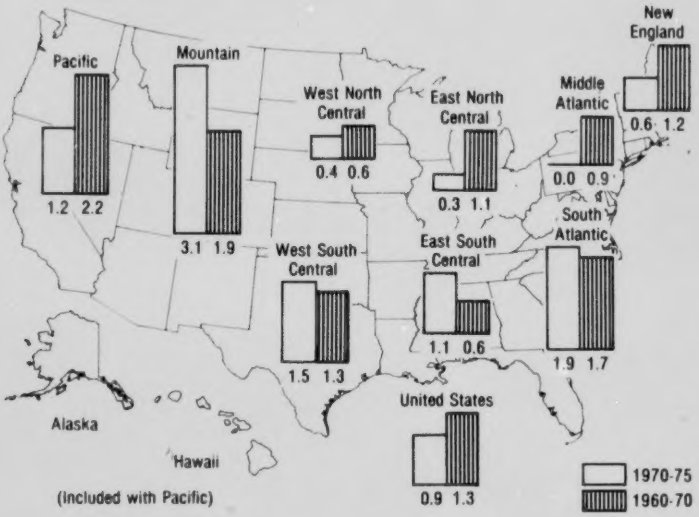
Although the rate of growth is expected to decrease gradually, the 1970's will experience more population growth than any other decade in history—over 800 million, 88 percent of them in the Third World.[168] Simply maintaining standards will strain the economic, social, and environmental systems of these countries as never before, and living standards are already inadequate.

Since the 1974 World Population Conference, many nations have taken steps to moderate population growth. Cumulative funds provided to the U.N. Fund for Population Activities grew from $121 million through 1973[169] to $318 million through 1976.[170] The U.N. World Fertility Survey is now well underway. Further assistance through the U.S. Agency for International Development increased from $103 million for fiscal year 1976 to $143 million for fiscal year 1977, not including $33 million appropriated for the July–September 1977 transitional quarter.[171]

Migration to the large cities, especially in developing countries, has compounded the problems of phenomenal population increases. Vast

Figure 68

Population, Average Annual Percent Change, 1970–75



Pacific
1.2 2.2
Mountain
3.1 1.9
West North Central
0.4 0.6
East North Central
0.3 1.1
Middle Atlantic
0.0 0.9
New England
0.6 1.2
West South Central
1.5 1.3
East South Central
1.1 0.6
South Atlantic
1.9 1.7
United States
0.9 1.3
Alaska
Hawaii
(Included with Pacific)
1970-75
1960-70

Source: Brian J. L. Berry and Donald C. Dahmann, *Population Redistribution in the United States in the 1970's* (Washington, D.C.: National Academy of Sciences, 1977), p. 18.

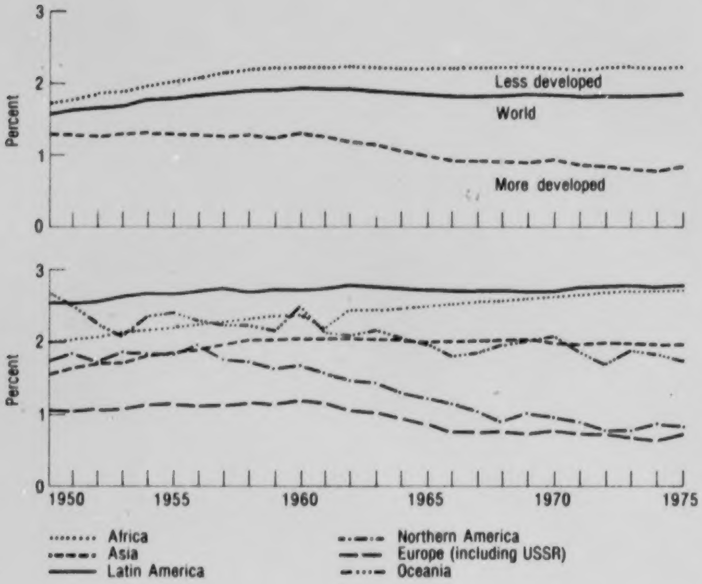
rural-to-urban migrations resulting from shortages of land, work, and food in the countryside are adding to natural increases in the population of cities. The growth is so rapid that urban institutions cannot keep up with the needs for employment, sanitation, housing, potable water supply, health services, and so on. By 2000, one-half the world population of 6.3 billion is expected to be living in cities, compared with 39 percent of today's. Between 1950 and 2000, urban population in developing countries is expected to increase almost 8-fold, with a 2.4-fold increase in developed countries (see Figure 72). In Latin America, 75 percent of the population will live in cities by the year 2000.[172] Table 24 lists past and projected size of selected urban areas as of 1975.

HOUSING

Despite the obvious deterioration of housing and neighborhoods in sections of U.S. cities, both quantity and quality of our housing stock have generally improved in the past 3 decades. As shown in Figure 73, the number of housing units has steadily increased at a rate exceeding the population growth rate largely because the average family is smaller—down from an average of 3.7 individuals in

Figure 69

Average Annual World Population Growth Rates, 1950-75



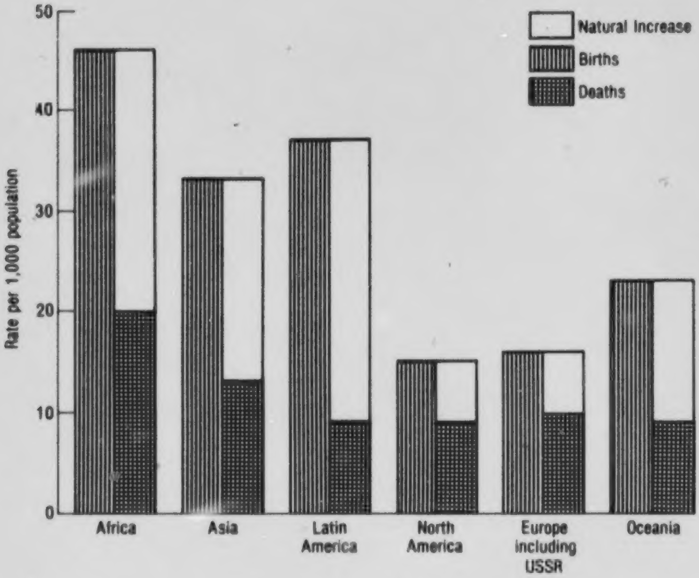
Source: U.S. Department of Commerce, Bureau of the Census, *World Population: 1975* (Washington, D.C.: Government Printing Office, 1976), p. 10 and "Average Annual Growth Rates for the World and Continents: 1950–75," 1976.

1940 and 2.9 in 1975. These smaller families also have more space. The typical new home of the late 1940's had about as much floor space as the typical new mobile home of 1976 and was one-half the size of the typical new home today.[173] The housing stock has also improved. According to a 1974 housing survey, lack of plumbing, leaking roofs, inadequate heating, and generally bad housing repair, common problems in the late 1940's, have almost been eliminated. Generally, however, low-income families still occupy homes with a number of defects, as shown in Table 25.

In late 1975, new housing production, which was depressed for several years, began to recover, reflecting the economic upturn (see Figure 74). Total private housing starts for 1976 were 1.5 million, up 33 percent from 1975. Single family housing production has been exceptionally strong, far exceeding multifamily housing construction. There were 1.2 million single family home starts in 1976, which represents the third highest production year on record (behind 1972 and 1959).

Figure 70

Birth, Death, and Natural Increase Rates by Continent, 1974



Source: U.S. Department of Commerce, Bureau of the Census, *World Population: 1975* (Washington, D.C.: Government Printing Office, 1976).

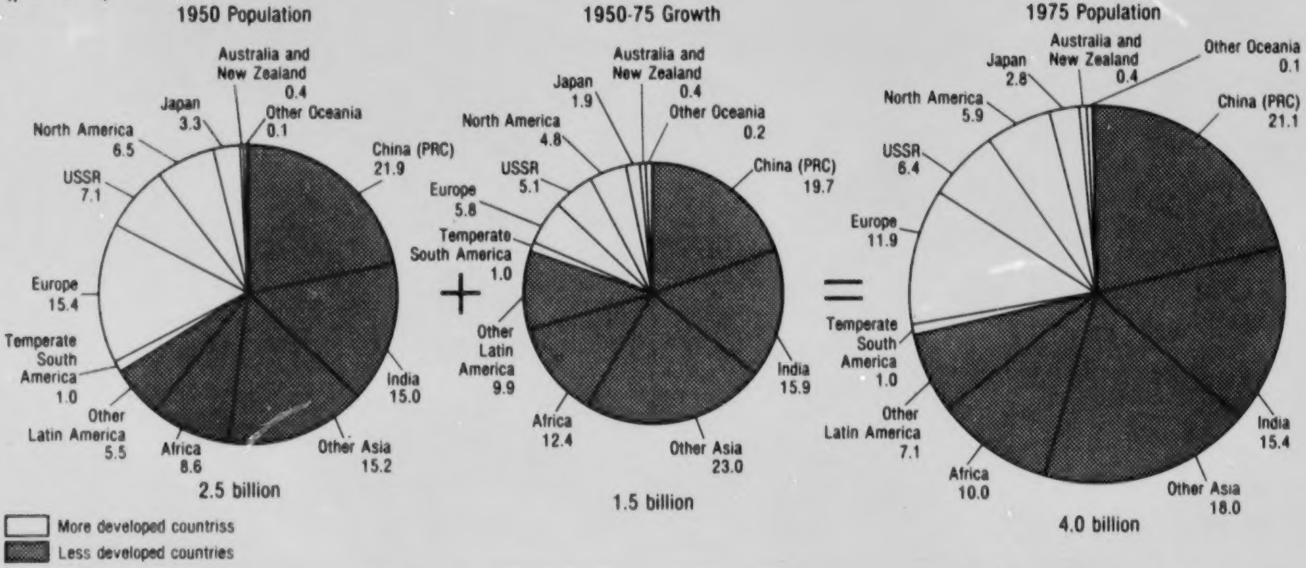
Although multifamily production rose by 40 percent during 1976, this growth figure is based on the abnormally low 269,000 units of 1975; production in 1976 was 377,000 units. Mobile home shipments during 1976 totaled an estimated 251,000, up 18 percent over 1975 (again a low year).

Although the rate of population growth in the United States has slowed considerably (see the earlier population discussion), the rate of household formation has increased. In the 1960's, when population grew at a rate of 1.3 percent, households were formed at a rate of 1.8 percent per year. In the 1970's, with population growing at a rate of 0.8 percent, households are being formed at a rate of 2.6 percent per year,[174] increasing demands on available housing and tending to raise prices.

There is increasing concern about housing prices, which reached a record high median price of $46,000 (for single family homes) in June 1976 before leveling off. For many families—both owners and renters—incomes are not keeping up with prices. Although a reactivated and revised Federal Home Ownership and Assistance Program

Figure 71

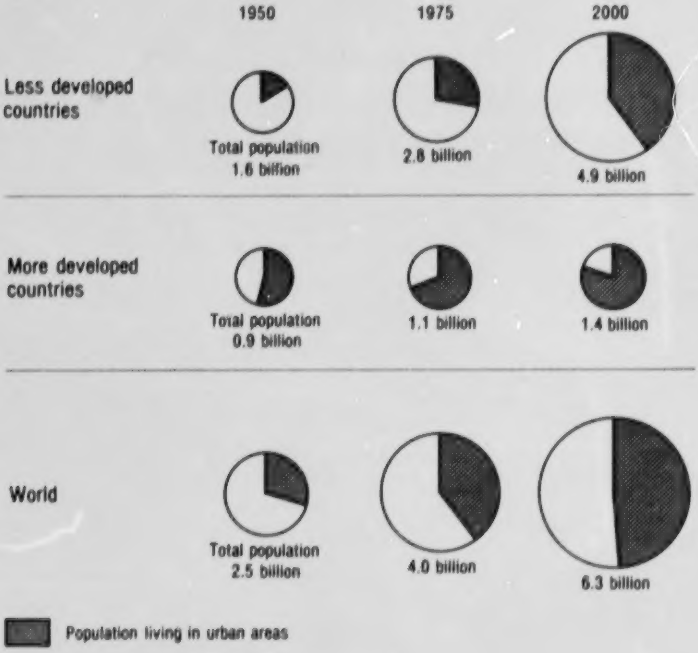
World Population Growth, 1950–75
(percent)



Source: U.S. Department of Commerce, Bureau of the Census, *World Population: 1975* (Washington D.C.: Government Printing Office, 1976), p. 11.

Figure 72

World Urbanization, 1950 to 2000[1] (percent)



[1] Includes Temperate South America, Northern America, Japan, Europe, Australia, New Zealand, and the Soviet Union.

Source: George J. Beier, "Can Third World Cities Cope?" *Population Bulletin* 31 (4):2 (1976), based on United Nations Population Division, "Trends and Prospects in Urban and Rural Population, 1950–2000 as assessed in 1973–1974," ESA/P/WP.54 (New York, 1975), Table C, medium variant. Courtesy of the Population Reference Bureau, Inc., Washington, D.C.

for moderate income families supported only 130 units in 1976 and 240 in the transition quarter, HUD believes that as more people learn about the program, it will finance 60,000 units in fiscal year 1977 and 100,000 units in 1978.[175]

For lower income housing the primary vehicle of federal aid is the Section 8 Housing Assistance Program,[176] under which the government pays the difference between the actual rent and what the tenant is able to pay. More than 110,000 families were occupying subsidized units by December 1976. HUD set a goal of more than 365,000 by the end of September 1977.[177]

With increased housing prices interest in rehabilitating existing housing has increased. From 1969 to 1978 almost 400,000 units will

Table 24

Selected Large Urban Area Populations, 1950–2000

City	Population (millions)		
	1950	1975	2000
Tokyo	6.7	17.3	26.1
New York	12.3	17.0	22.2
Shanghai	5.8	10.9	19.2
Mexico City	2.9	10.9	31.6
London	10.2	10.7	12.7
Sao Paulo	2.5	10.0	26.0
Buenos Aires	4.5	9.3	14.0
Paris	5.4	9.2	12.3
Peking	2.2	8.5	19.1
Rio de Janeiro	2.9	8.3	19.4
Calcutta	4.4	8.1	19.7
Seoul	1.0	7.3	18.7
Bombay	2.9	7.1	19.1
Cairo	2.4	6.9	16.4
Jakarta	1.6	5.6	16.9
Karachi	1.0	4.5	15.9
Manila	1.5	4.4	12.7
Bogota	0.7	3.4	9.5
Lagos	0.3	2.1	9.4
Kinshasa	0.2	2.0	9.1

Source: George J. Beier, "Can Third World Cities Cope?" *Population Bulletin* 31(4):9 (1976), based on United Nations Population Division, "Trends and Prospects in the Populations of Urban Agglomerations, 1950–2000, as Assessed in 1973–1975," ESA/P/WP.58 (New York, 1975), Table C. Courtesy of the Population Reference Bureau, Inc., Washington, D.C.

Table 25

Occupied Housing with Specified and Multiple Defects, 1974

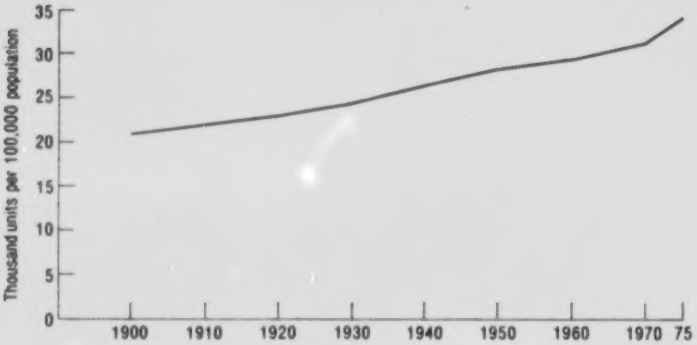
(thousand units)

Number or type of defects	Total units in group	Percent of total stock	Average income of households
None	40,827	57.6	$13,300
1	18,668	26.4	12,600
Electrical	1,658	2.3	10,500
Kitchen	218	.3	7,700
Plumbing	3,303	4.7	12,000
Bathroom	166	.2	8,800
Heating	1,810	2.6	14,300
Roof or basement leaks	6,030	8.5	14,300
Walls, floor or ceiling cracks or holes	2,960	4.2	10,700
Vermin	2,523	3.6	12,400
2	7,193	10.2	10,700
3	2,564	3.6	9,500
4	1,047	1.5	7,300
5	407	.5	6,300
6	119	.2	4,700
7	5	0	5,400
8	0	0	

Source: U.S. Congress, House, *Ninth Annual Report on the National Housing Goal*, House Doc. 53, 95th Cong., 1st Sess., 1977, p. 15.

Figure 73

Housing Increases, 1900–75



Sources: U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States: 1976* (Washington, D.C.: Government Printing Office, 1976), Table 2, p. 5, and Table 1273, p. 744; U.S. Department of Commerce, Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970* (Washington, D.C.: Government Printing Office, 1975), p. 646; and U.S. Department of Commerce, Bureau of the Census, and U.S. Department of Housing and Urban Development, *Annual Housing Survey, 1975, Part B, Indicators of Housing and Neighborhood Quality* (Washington, D.C.: Government Printing Office, 1977), p. 1.

have been substantially rehabilitated, including 227,300 units in 1- to 4-unit structures and 146,570 units in multifamily structures.[178]

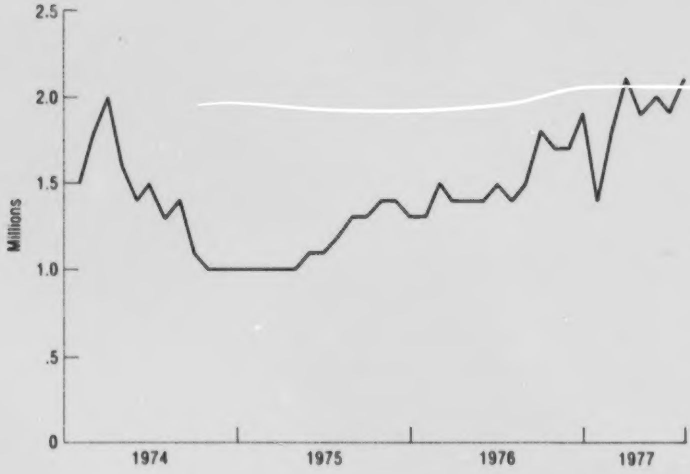
Various government programs, described in the human settlements section of Chapter 1, are designed to promote rehabilitation. More than 11,000 units of existing HUD- or city-owned structures were approved by September 30, 1976, for acquisition and rehabilitation by local housing authorities to provide low-rent housing.[179] Negotiating special wage agreements between unions and contractors for the work, HUD has earmarked $50 million to rehabilitate another 12,000 units for low-income families.[180]

An increasing proportion of Community Development Block Grant funds is being allocated to housing rehabilitation. Local officials planned to rehabilitate approximately 66,000 units during 1975 and 90,000 units during 1976 with their CDBG funds, allocating a total of $532 million for this purpose over the 2 years. Federal funds spent for neighborhood improvements frequently generate private rehabilitation investment. HUD has estimated that every CDBG dollar spent is drawing approximately $2.40 in private investment.

The Urban Homesteading Demonstration program makes HUD-owned single family properties available for a minimal amount to individuals agreeing to rehabilitate and live in the houses for a given length of time. When the program changed from demonstration to operating status in fiscal year 1977, the number of cities increased

Figure 74

Housing Starts, 1974–77[1]



[1] Annual rates seasonally adjusted; January–December = 1974–76; January–July = 1977.

Source: U.S. Department of Commerce, Bureau of the Census, *Housing Starts* (Washington, D.C.: Government Printing Office, 1977), January 1977, p. 8 and August 1977, p. 7.

from 23 to 39. Approximately 1,000 houses are expected to be transferred each year.

The high priority given to rehabilitation is reflected in the growing demand for home improvement loans to households. The number of such loans was 17 percent higher in the first 11 months of 1976 than during the same period in 1975. Low interest loans for rehabilitating approximately 4,400 units totaled $39 million during fiscal year 1976.[181] A program level of $70 million is planned for 1978.

NEIGHBORHOOD SATISFACTION

In a recent sample survey taken by the Department of Housing and Urban Development, 81 percent of households in Standard Metropolitan Statistical Areas rated their neighborhoods as excellent or good.[182] Residents in the central cities of these SMSA's gave their neighborhoods a somewhat less favorable rating, with 73 percent reporting good or excellent conditions.

In central cities, 38 percent objected to street noise compared to 33 percent in suburban and nonmetropolitan households. Crime was a concern for 28 percent of the households in central cities, for 18 percent in the suburbs, and for 10 percent of residents in nonmetropolitan areas. Public transportation was found inadequate by 13 percent of households in central cities, 41 percent in the suburbs, and 53 percent outside SMSA's. Schools and fire protection were generally satisfactory, but there was some dissatisfaction with health facilities and shopping, particularly in rural areas.

HISTORIC AND CULTURAL PROPERTIES

Preservation of valuable historic and cultural properties contributes to the character and quality of neighborhoods and communities. Since the establishment of the National Register of Historic Places in 1966,[183] approximately 14,000 properties have been listed. The grants program, begun at $2 million in 1967, has awarded some 1,600 grants totaling $55 million in its first 10 years, $41 million to the states and the remainder to the National Trust for Historic Preservation. It was authorized at $45 million for fiscal year 1978 and budgeted at $35 million. In the last several years, nearly three-quarters of the states were prepared to spend substantially more than the amount of the federal funds available. With the increased appropriation, many projects in older city neighborhoods may now be considered for funding.

Early emphasis was on individual buildings or properties; now there is more interest in entire districts. In 1972 there were approximately 3,500 individual properties and only 125 historic districts listed on the National Register. At latest count, 1,282 districts, 11 percent of the total, are listed.[184] Urban areas over 50,000—Wooster Square in New Haven, Connecticut, is one—comprise one-quarter of the listings. One-quarter is rural, for example, Green Springs, Virginia, a 14,000-acre area of 18th and early 19th century farms. One-half is in towns under 50,000, all of Sisterdale, Texas, and Silver Plume, Colorado, for example. In two-thirds of the areas, buildings are in residential use, and in one-half they are in commercial use. Archeological districts comprise 12 percent of the total.

The 1974 Housing and Community Development Act[185] specifically recognizes historic preservation as an acceptable means of achieving program objectives. In the first year of the Community Development Block Grant Program, $15 million was spent on historic preservation. In the past year under this program funds were available for 25 historic districts, 29 historic houses, 10 city halls, 6 county courthouses, 8 parks, 5 railroad stations, and other projects as well. The potential for federal assistance for historic and cultural preservation is indicated by the fact that the recently supplemented *Guide to Federal Programs in Historic Preservation* lists over 200 possible sources of federal support for various preservation activities, including research.[186]

URBAN RECREATION

Higher incomes and more leisure time have increased the demand for recreation, particularly in urban areas. The problem with satisfying this demand is usually not a lack of available park space but rather accessibility, maintenance, and operation of the space. These facts are among the findings in a preliminary study of 28 cities conducted by the National Park Service and the Bureau of Outdoor Recreation on the federal role in urban parks and on innovative park preservation.[187] (See the discussion on urban recreation in Chapter 1.)

Population of the 28 SMSA's studied totals 38.9 million, about 25 percent of the U.S. urban population in 1973. Sizes range from that of New York City (9.7 million) to Midland, Texas (66,000). The sample SMSA's generally represent the more affluent urban areas; they range from Nassau-Suffolk, with the third highest per capita income of the 266 SMSA's in the nation, to Duluth, 131st on the list.[188]

Virtually all appeared to have problems in providing urban recreation. Although some cities had too little park space, in nearly every SMSA, accessible, affordable recreation space could be available, primarily along rivers, waterfronts, and coastlines. Access to parks was identified as a serious problem for inner-city residents. Ninety percent of the visitors to the new Gateway National Recreation Area in New York arrive by automobile—in a city where one-half the households have no car. Neighborhood parks within walking distance of residences are in short supply in such older cities as Syracuse, St. Louis, and Milwaukee. Further, most SMSA's find difficulties in developing, maintaining, and operating the park spaces that they do have.

Recreational properties can be acquired and developed through the Land and Water Conservation Fund.[189] From its current $300 million per year, the annual authorization level of this fund will climb to $600 million in fiscal year 1978, $750 million in 1979, and $900 million from 1980 through 1989. Approximately 60 percent of the annual authorization will be available to the states and territories and no less than 40 percent to federal land-managing agencies.

In the first 13 years of the Fund, states and communities were able to set aside 1.7 million acres. Their 19,000 outdoor recreation projects include 1,300 swimming pools, 1,700 tennis courts, 470 bike routes, and 350 public golf courses. Public acquisition of beaches, flood plains, coastal islands, and oyster beds and access to trails and forests have been assisted by the Fund.[190]

The program generally favors projects located outside SMSA's, as indicated in Tables 26 and 27. Section 12 of the new Amendments to the Land and Water Conservation Fund Act [191] calls on the Secretary of Interior to prepare a comprehensive report on the needs, problems, and opportunities associated with urban recreation, including the resources available for meeting those needs. This study

Table 26

Land and Water Conservation Fund State Obligations by Type of Project, Location, and Fiscal Year [1]

(thousand dollars)

Fiscal year	Acquisition	SMSA development	Total	Acquisition	Non-SMSA development	Total	Acquisition	LWCF total development	Total
1966	1,667	3,616	5,282	4,113	5,091	9,204	5,780	8,707	14,487
1967	27,982	28,543	56,525	17,785	33,982	51,767	45,767	62,525	108,292
1968	14,030	20,444	34,474	14,495	23,775	38,270	28,525	44,219	72,744
1969	21,228	17,136	38,364	10,362	19,564	29,926	31,590	36,700	68,290
1970	15,443	12,657	28,100	5,073	13,588	18,661	20,516	26,245	46,761
1971	32,108	41,285	73,393	14,073	23,786	37,859	46,181	65,071	111,252
1972	55,580	63,315	118,895	23,942	45,443	69,385	79,522	108,758	188,280
1973	59,390	74,791	134,181	21,536	49,563	71,099	80,926	124,354	205,280
1974	55,400	44,888	100,288	28,473	44,122	72,595	83,873	89,010	172,883
1975	46,853	50,601	97,454	21,825	38,581	60,406	68,678	89,182	157,800
1976	44,627	52,395	97,022	16,701	35,854	52,555	61,328	88,249	149,577
Total	374,308	409,671	783,979	178,378	333,349	511,727	552,686	743,020	1,295,706

[1] Does not include projects approved during transition quarter.

Source: U.S. Department of the Interior, *A Preliminary Urban Parks Study* (Washington, D.C., 1977), Table 3.

Table 27

Land and Water Conservation Fund Distribution of Expenditures, per Capita, 1966–77

(dollars)

Project	Inside SMSA's	Outside SMSA's
Local	3.59	3.61
State	2.07	4.48
Total (state and local)	5.66	8.09
Federal	1.58	6.60

Source: U.S. Department of the Interior, *A Preliminary Urban Parks Study* (Washington, D.C., 1977), pp. 33, 37.

addresses the role of the Land and Water Conservation Fund and other sources of federal assistance in meeting the broad spectrum of urban recreation needs.

Cities may also use surplus federal property for parks and recreation. In May 1977 the Secretary of Interior announced that 1,400 acres of surplus federal land will be donated in 19 parcels to state, county, and city governments for public outdoor recreation. The Federal Property and Administrative Service Act of 1949 authorizes such use of unneeded federal land holdings.[192]

TRANSPORTATION

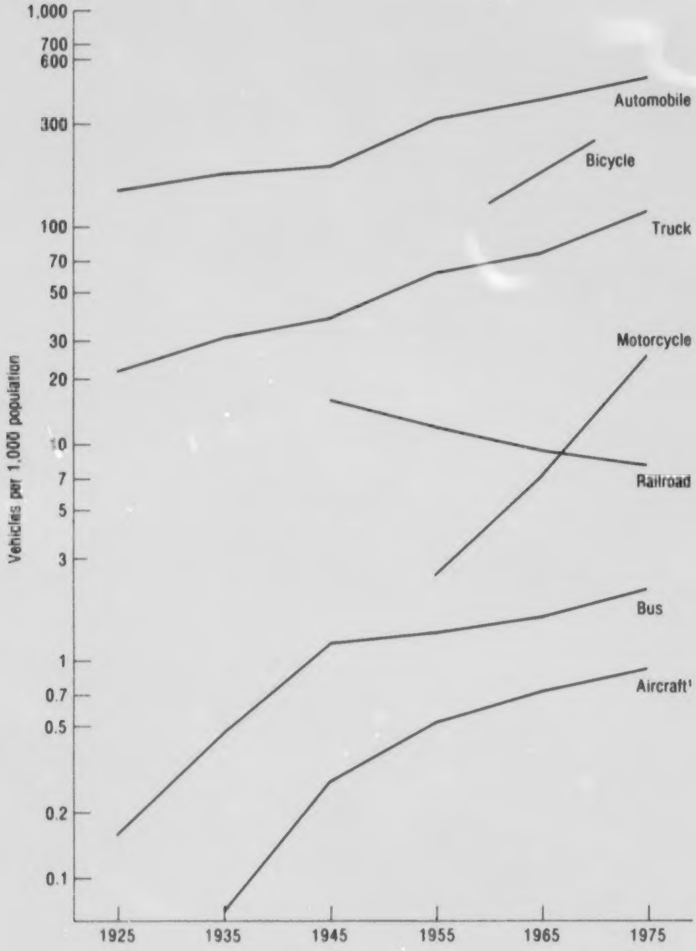
The number of vehicles has continued to increase since World War II. There is now one automobile for every two people, and one-half the trucks are owned and operated for personal use (see Figure 75). Figure 76 shows that in 1975 most local per capita passenger miles were traveled by automobile rather than by other modes of transportation.

Bicycle use rose sharply between 1970 and 1975, and the rate of increase in automobile use and bus travel between 1970 and 1975 slowed. Figure 77 on interurban transportation reveals trends similar to those for intraurban transportation. The auto and the airplane continued to account for larger shares of interurban passenger miles than buses and trains; interurban railroads now carry only about 4 percent of the number of passengers carried in the mid-1920's and early 1940's. However, these rates of increase and decline were lower between 1970 and 1975 than in earlier periods.

The same basic transportation trends of the fifties and sixties have continued into the middle seventies in the face of increases in energy prices and drops in real personal income. Even when energy prices rose and incomes fell, people still chose to spend a larger portion of their smaller incomes on the energy-intensive methods of travel, the automobile and the airplane.

Figure 75

Intra- and Interurban Vehicle Transportation, 1925–75

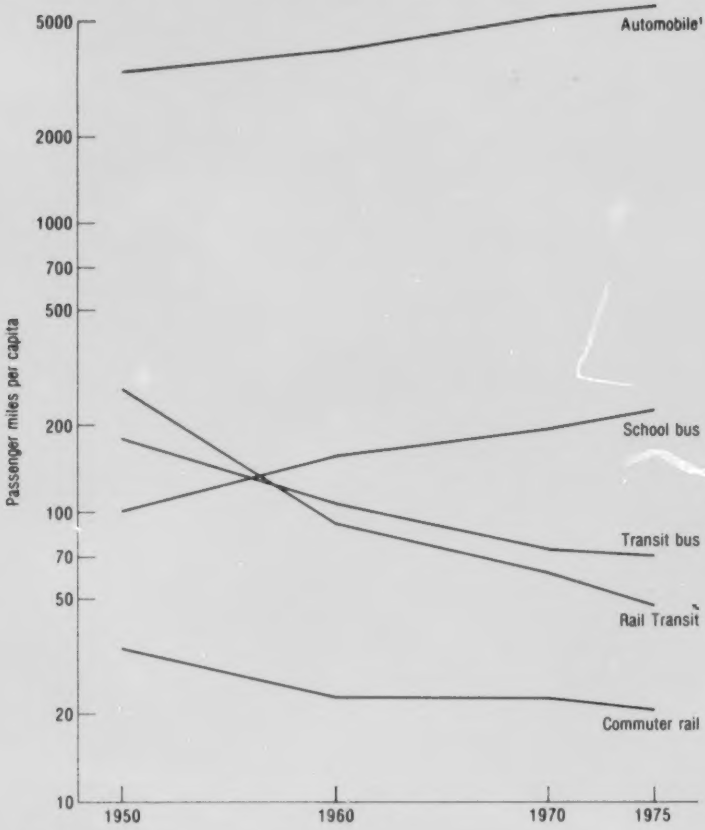


[1] Includes commercial airline and general aviation.

Sources: For aircraft: for 1925–73, U.S. Department of Commerce, Bureau of the Census, *Historical Statistics of the United States from Colonial Times to 1970*, p. 772; for 1974, *Statistical Abstract of the United States: 1976*, p. 613; for 1975, estimated using 1970–75 average increase. For automobiles: for 1925–45, *Historical Statistics*, p. 716; for 1950–75, *Statistical Abstract*, p. 593. For bicycles: U.S. Environmental Protection Agency, *Bicycle Transportation*, p. 49. For buses and trucks: for 1925–70, *Historical Statistics*, p. 716; for 1975, Federal Highway Administration, *Highway Statistics 1975*, p. 11-3. For motorcycles: *Statistical Abstract*, p. 593. For railroad cars: Association of American Railroads, *Yearbook of Railroad Facts 1976* (Washington, D.C.), pp. 51, 54. Government documents published by the Government Printing Office. Semilog scale used.

Figure 76

Intraurban Passenger Transportation, 1950-75



[1] Includes taxis and personal trucks.

Source: Department of Transportation, Office of the Secretary, Transportation Planning.

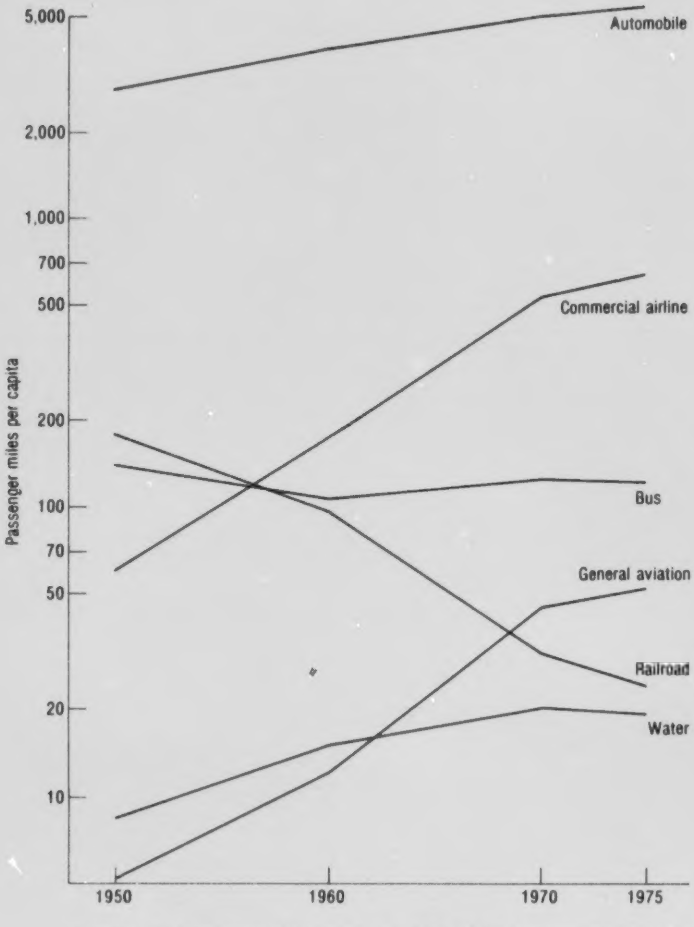
ECONOMICS

Industry and municipalities have rapidly increased their pollution control expenditures to meet the standards and deadlines of the Clean Air Act and the Federal Water Pollution Control Act during this decade, but as Table 28 indicates, the proportion of plant and equipment expenditures for pollution abatement has not increased substantially in the last 5 years.

With increased investment come increased operation and maintenance costs. We now have several years' data on these costs for industry as well as municipalities. O&M costs for manufacturers, shown

Figure 77

Interurban Passenger Transportation, 1950–75



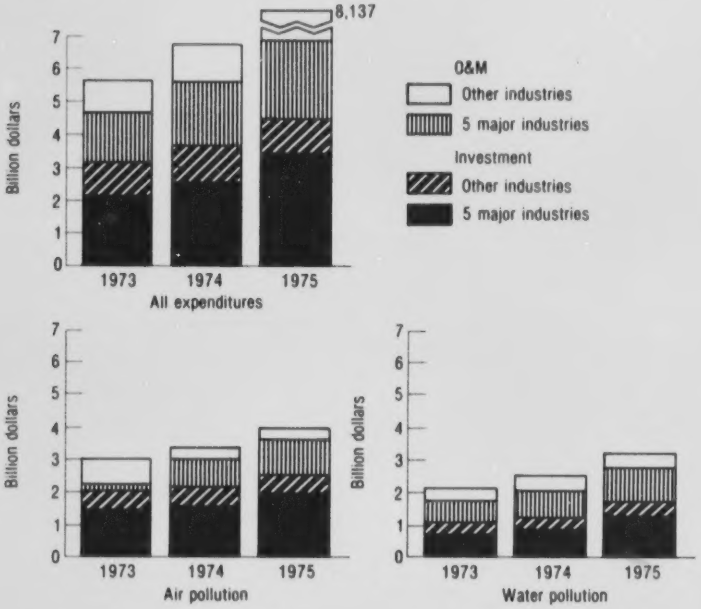
Source: U.S. Department of Transportation, Office of the Secretary, Transportation Planning. Semilog scale used.

in Figure 78, are running one-third to one-half the total investment expenditures. As more pollution control equipment is installed, the O&M costs will increase and will continue after the rate of investment declines.

In 1977 industry spent slightly more for air pollution control devices than it spent for water pollution control facilities.[193] However, water pollution expenditures will probably increase signifi-

Figure 78

Total Pollution Abatement Expenditures by Industry,[1] 1973–75



[1]The five major industries are pulp and paper, chemicals, petroleum and coal, ferrous metals, and nonferrous metals.

Source: U.S. Department of Commerce, Bureau of the Census, *Pollution Abatement Costs and Expenditures* (Washington, D.C.: Government Printing Office, 1975), MA-200(75)-1, Table 1a.

cantly in order to meet the 1983 goals of the Water Pollution Control Act.

The amounts that federal, state, and local governments are spending on transactions costs—expenditures to implement and enforce pollution control requirements and expenditures on associated research—also increased rapidly in this decade, reaching $3.1 billion in 1977.[194]

CEQ estimates that the nation spent $40.6 billion for pollution control in 1977, approximately $187 per capita. Of this amount, only $18.1 billion is in response to environmental legislation, and the remainder would have been spent in the absence of such legislation.

The 1977 estimate is shown in detail in Figure 79. Of total outlays, industry accounted for 50 percent, government for 30 percent, and consumers directly for 20 percent. Air pollution abatement received 32 percent of the funds, water 38 percent, solid waste manage-

Table 28

Pollution Control Investment by Industry

(million dollars)

	Reported expenditures 1976				Pollution control as a percent of total plant and equipment investment				
	Total[1]	Air	Water	Solid wastes	Actual[2] 1973	Actual 1974	Actual 1975	Actual 1976	Planned 1977
All industries	6,762	3,593	2,743	426	4.9	5.0	5.8	5.6	5.6
Manufacturing	4,382	2,105	1,993	284	8.3	8.0	9.3	8.3	7.9
Durable goods	1,560	952	537	72	8.1	7.3	8.1	6.6	7.0
Primary metals	923	661	250	12	23.4	16.6	17.2	15.7	17.3
Blast furnaces, steel works	446	272	173	1	16.3	12.1	13.5	15.1	19.1
Nonferrous metals	405	323	71	11	31.1	21.8	24.1	18.9	17.1
Electrical machinery	148	44	86	19	4.5	6.8	5.8	5.6	4.1
Machinery, except electrical	80	40	30	10	2.3	1.8	1.8	1.6	2.4
Transportation equipment	125	53	51	21	5.6	3.7	3.4	3.4	4.1
Motor vehicles	90	32	39	19	6.4	4.1	3.9	3.6	4.3
Aircraft	32	20	11	2	3.8	2.9	2.8	3.3	2.8
Stone, clay, and glass	103	74	25	5	9.6	12.9	14.3	6.1	6.7
Other durables	181	81	95	5	4.9	4.5	5.3	3.9	3.9

Nondurable goods	2,821	1,153	1,456	212	8.5	8.7	10.3	9.6	8.7
Food, including beverages	175	90	75	10	5.0	4.7	5.2	4.5	4.9
Textiles	37	11	24	2	3.7	3.3	4.6	4.4	3.8
Paper	511	182	304	25	18.8	19.3	16.8	14.7	14.1
Chemicals	765	287	433	45	9.6	8.3	10.9	11.4	10.2
Petroleum	1,275	554	594	126	10.3	10.1	11.8	10.9	9.5
Rubber	37	20	14	3	3.1	3.2	4.0	3.4	2.7
Other nondurables	23	9	11	2	1.2	1.8	2.8	1.4	1.8
Nonmanufacturing	2,381	1,488	750	142	2.9	3.0	3.2	3.5	3.6
Mining	86	47	29	10	3.3	1.8	1.9	2.2	2.9
Railroad	27	8	17	2	0.8	1.2	1.4	1.1	0.8
Air transportation	16	12	2	2	0.6	0.0	0.6	1.2	0.8
Other transportation	38	11	26	1	0.7	2.3	1.4	1.1	1.6
Public utilities	2,032	1,332	600	100	7.6	7.9	8.4	9.1	9.3
Electric	1,990	1,312	579	99	8.7	8.9	9.7	10.5	10.9
Gas and other	42	20	21	1	1.5	1.5	1.5	1.2	0.8
Communication, commercial, and other	182	79	76	27	0.6	0.6	0.6	0.5	0.5

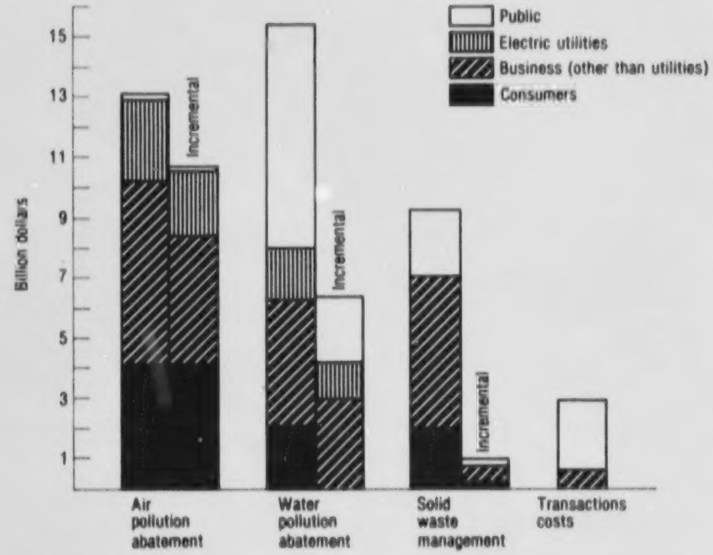
[1] Totals may not add because of rounding.

[2] Does not include solid wastes for 1973.

Source: U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business* 55(7):15 (1975) and 57(6):13 (1977).

Figure 79

Estimated Pollution Control Expenditures, 1977

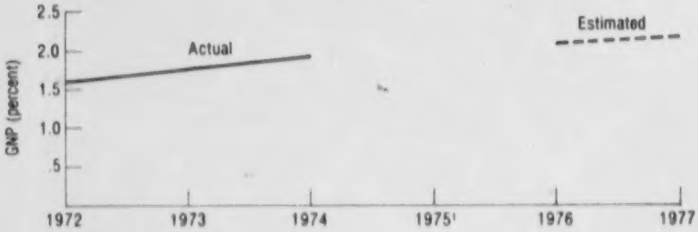


ment 23 percent, and transactions costs the remaining 7 percent. The estimate indicates that 2.1 percent of the GNP was spent on pollution abatement in 1977, up from 1.76 percent in 1973, shown in Figure 80.

As indicated throughout this report, we have made important improvements in our environment and are realizing such economic

Figure 80

Pollution Abatement Expenditures as a Percent of Gross National Product, 1972–77



[1] No estimate for 1975.

Source: For 1972–74, U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business* 57(2):15 (1977).

benefits as lower expenditures for health maintenance and for protection, maintenance, and repair of property as well as such nonmonetary benefits as improved recreational opportunities, clearer views, and other esthetic and psychological improvements.

The result of our environmental programs is expected to be a substantially improved quality of life for all citizens, both today and in the future. Some improvements can be roughly estimated in monetary terms. Others cannot. The 1975 Annual Report summarized estimated benefits at that time.

Since then little has been done to provide better economic measures of the benefits attributable to environmental control programs. Nevertheless, the benefits are expected to exceed the costs substantially. Unfortunately, it is not possible to quantify the benefits along with the costs. It should also be recognized that because of the time required to install pollution control devices and the lag in phasing out older automobiles and older facilities that pollute, benefits are expected to lag behind these abatement expenditures.

COST PROJECTIONS

Each year the Council estimates costs of complying with environmental regulations over a 10-year period. As detailed in Table 29, this year's projection of incremental abatement costs (the additional costs resulting from federal environmental regulations beyond what would have been spent in the absence of environmental legislation) totals $289.1 billion for 1976 through 1985. Fifty-three percent, $153 billion, is for air pollution control and 40 percent, $117 billion, is for water pollution control. The remainder is for solid wastes, noise, toxic substances control, land reclamation, and control of radioactive materials. Total cost estimates are given in Table 32 at the end of this section.

The difference between the current estimate and last year's is caused by inflation (the 1977 estimate is in 1976 dollars; the 1976 estimate was in 1975 dollars), a change in the period covered (we added 1985, a high cost year, and dropped 1975, a lower cost year), and modification of environmental regulations since preparation of last year's estimate. By itself, inflation would have caused a $12 billion increase. The change in years covered accounts for most of the remaining difference.

Changes in environmental control requirements were authorized by the 1977 Amendments to the Clean Air Act, hazardous substances control legislation (part of the Resource Conservation and Recovery Act of 1976), the Toxic Substances Control Act of 1976, and the Strip Mining Control Act of 1977, described in Chapter 1. Cost estimates, which are necessarily preliminary, may be modified substantially as regulations implementing the legislation are prepared and the economic impacts better understood.

Table 29

Estimated Incremental Pollution Abatement Expenditures,[1] 1976–85

(billion 1976 dollars)

	1976			1985			Cumulative (1976–85)			
	Operation and maintenance	Capital costs [2]	Total annual costs [3]	Operation and maintenance	Capital costs [2]	Total annual costs [3]	Capital investment	Operation and maintenance	Capital costs [2]	Total annual costs [3]
Air pollution										
Public	0.1	0.1	0.2	0.7	0.2	0.9	2.0	4.5	1.9	6.4
Private										
Mobile	3.4	2.0	5.4	0.8	7.5	8.3	52.5	18.4	53.8	72.2
Industrial	1.1	1.1	2.2	2.4	2.8	5.2	13.3	16.7	20.8	37.5
Utilities	0.8	0.8	1.6	3.1	3.1	6.2	16.2	18.5	18.5	37.0
Subtotal	5.4	4.0	9.4	7.0	13.6	20.6	84.0	58.1	95.0	153.1
Water pollution										
Public	1.2	0.3	1.5	4.5	2.2	6.7	24.0	28.5	12.5	41.0
Private										
Industrial	1.3	1.2	2.5	5.9	4.4	10.3	35.2	34.5	28.3	62.8
Utilities	0.5	0.3	0.8	0.9	0.6	1.5	2.3	8.1	4.9	13.0
Subtotal	3.0	1.8	4.8	11.3	7.2	18.5	61.5	71.1	45.7	116.8
Radiation										
Nuclear powerplants	<0.05	<0.05	<0.05	<0.05	<0.05	0.1	0.2	0.1	0.3	0.4
Solid wastes										
Public	0.2	0.1	0.3	0.3	0.1	0.4	1.1	2.6	0.8	3.4
Private	0.3	0.2	0.5	0.9	0.4	1.3	1.4	5.9	1.0	6.9
Subtotal	0.5	0.3	0.8	1.2	0.5	1.7	2.5	8.5	1.8	10.3
Land reclamation										
Surface mining	NA[4]	NA	NA	0.5	NA	0.5	NA	3.6	NA	3.6
Toxic substances	NA	NA	NA	0.2	NA	0.2	NA	1.1	NA	1.1
Noise	NA	NA	NA	0.4	0.4	0.8	2.7	1.8	2.0	3.8
Total	8.9	6.1	15.0	20.6	21.7	42.4	150.9	144.3	144.8	289.1

[1] Incremental costs are expenditures made pursuant to federal environmental legislation beyond those that would have been made in the absence of such legislation.

[2] Interest and depreciation.

[3] Operation and maintenance plus capital costs.

[4] NA=Not available.

The major cost-affecting sections of the Clean Air Act Amendments modify requirements for automobile emissions, provide for the prevention of significant deterioration of air quality in clean air regions, and require adoption of the "best technological system of continued emission reduction" by all new sources.

The impact of the automobile emission standards will depend upon the control technology adopted. More advanced technologies are expected to result in higher initial automobile costs but not in the fuel economy loss associated with a less advanced technology. Costs and impacts on fuel economy are estimated in Table 30, which compares the impacts of the emission control requirements included in the 1977 Clean Air Act Amendments to costs and energy losses associated with pollution control devices installed on an average 1977 vehicle. These cost estimates do not include the pollution control costs experienced by manufacturers of vehicle parts and materials, which, when passed through in higher materials and parts prices, may add $37 to the price of a new car.[195] Nor do they include required vehicle safety devices which may add $362 to the price.[196]

The total costs associated with new standards, shown in Figure 81, assume that vehicles manufactured in 1985 incorporate the fuel-optimal technology. For that year $6.1 billion (1976 dollars) is projected. If the cost-optimal technology were adopted, the total cost would be $5.7 billion.

With respect to preventing air quality degradation in areas already cleaner than standards, EPA and FEA estimated additional costs for the industries most affected—electric utilities and nonferrous metals. Coal-fired utilities will have to spend $2.1 billion more [197] and copper smelters perhaps $100 million more [198] in air pollution control for

Figure 81

Automobile Pollution Abatement Costs, 1968–85

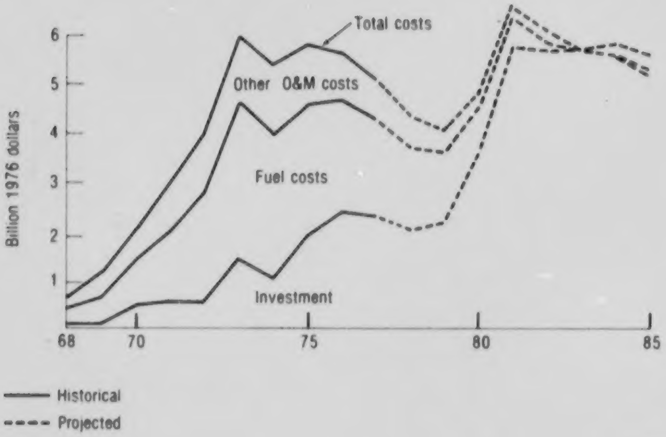


Table 30

Estimated Cost and Fuel Economy Impacts of Alternative Emission Control Requirements, 1985 [1]

Emission control requirements (HC/CO/NO, grams per mile)	Cost-optimal control system [2]			Fuel-optimal control system [3]		
	Initial cost	Maintenance cost [4]	Fuel economy (percent)	Initial cost	Maintenance cost [4]	Fuel economy (percent)
	(current dollars)			(current dollars)		
1977 Vehicles (1.5/15/2.0)	Base	Base	Base	Base	Base	Base
1977 Amendments (0.41/3.4/1.0)	175 to 220	15 to 55	−4 to −3	220 to 285	70 to 70	2 to 2
Standards originally required in 1985 [5] (0.41/3.4/0.4)	195 to 285	0 to 90[6]	−8 to −8	300 to 360	0 to 110[6]	2 to 2

[1] All impacts are relative to control systems used on the average vehicle produced in 1977. Figures indicate the range for light weight vehicles (less than 3,000 pounds) and heavy vehicles.

[2] The emission control system which would satisfy the emission requirements at the lowest initial cost.

[3] The least cost system which would result in no loss in fuel economy.

[4] The change in maintenance costs over 100,000 miles.

[5] The 1970 Clean Air Amendments originally set a deadline of 1977 to achieve these standards, and they may ultimately be required under the 1977 amendments.

[6] These costs could vary within the range indicated for both light and heavy vehicles.

Source: Based on Department of Transportation, Environmental Protection Agency, and Federal Energy Administration, "An Analysis of Alternative Motor Vehicle Emission Standards," May 19, 1977, Table 14, p. 40.

new facilities in 1990. The additional costs are primarily associated with such factors as locating new plants away from the most protected areas (large National Parks and Wilderness Areas).

These costs are in addition to those resulting from the requirement that all new facilities install the best available control technology (BACT). It is not clear that new facilities could meet air pollution control requirements without installing the best available control technology, given the uncertainties about availability and costs of natural gas and oil and of other clean-burning fuels. However, assuming that they could use these fuels in the absence of the BACT requirement, this requirement could result in an estimated additional investment of $9.4 billion (in 1975 dollars) and increased operating costs of $14.1 billion for coal-fired utilities through 1990.[199]

Title III of the Resource Conservation and Recovery Act of 1976 requires the control of hazardous substances. These requirements are discussed in the solid wastes section of Chapter 1. Expenditures for the control of hazardous substances would be concentrated in the primary metals, chemicals, and petroleum refining industries. When this report was written, EPA was in the process of establishing standards and issuing regulations, and accurate cost estimates were not available. However, preliminary information indicates that the hazardous waste provisions could increase disposal costs $200 to $300 million per year.

Final standards and regulations have not been written for the Toxic Substances Control Act of 1976. It is particularly difficult to estimate compliance costs because the law requires premarket testing of chemicals suspected of being toxic. The Act may not create substantial abatement costs in the traditional sense of the term, but higher costs will be associated with the additional chemical testing required and with delaying the introduction of new chemicals. These delay costs accrue to the manufacturers which suffer a loss in profits while commercialization is delayed and potentially to the consumers who forego the advantages of a new chemical. Very tentative and probably incomplete estimates indicate costs of compliance with the Toxic Substances Control Act at between $100 million and $200 million per year for 1985[200] in addition to the costs of testing and delay that manufacturers already experience in developing and introducing a new chemical.

Miners will experience additional costs imposed by the Strip Mining Act of 1977. The most important direct impacts are that miners must increase planning and exploration expenditures before opening mines in order to obtain the required permits, and they must increase expenditures after mining occurs to reclaim the strip mined land. The former expenditures are not large, but may be a problem for small miners. The estimated incremental compliance cost of both requirements (beyond existing state laws) is $0.50-$4 per ton of coal in Appalachia and $0.50 per ton in western mines.[201] With the accelerated coal production projections included in the President's Energy Plan, these costs will come to approximately $470 million per year by 1985.

ECONOMIC IMPACT

As reported in earlier annual reports, macroeconomic analyses sponsored by CEQ and EPA indicate that environmental programs are not expected to have a major impact on the economy.[202] The analyses indicated that during the recession the environmental regulations probably provided a net positive stimulus to the economy, resulting in a slightly higher GNP and lower unemployment. But as the economy pulls out of the recession, any stimulus becomes overshadowed by higher production costs and somewhat lower productive capacity resulting from environmental regulations, with the net result of a slightly lower rate of economic growth than would otherwise occur.

Although the nation's economy has begun to improve, there is still substantial concern about unemployment and how it is affected by environmental regulations. EPA continues to maintain its catalog of firms which have shut down or have threatened to shut down, claiming pollution control requirements as significant in their decisions. This "Early Warning System" indicates that from April 1976 through March 1977, closure of 15 plants affected 2,546 employees, raising the total for 1971 through March 1977 to 107 plant closures, affecting 20,318 employees.[203] The Bureau of Economic Analysis found about the same number of closures in its surveys, but it is not yet possible to determine whether the two surveys identified the same plants.

Pollution controls have also created jobs in municipal sewage construction, construction and operation of pollution control devices in industry, implementation of state and local government pollution control regulations, and operation of publicly owned pollution abatement facilities. In addition, there are jobs in manufacturing equipment and materials for pollution control facilities, and there is probably still some general economic stimulus leading to generally increased employment resulting from these expenditures.[204] The National Academy of Sciences' study of manpower needs for pollution control estimated that there were 677,900 people employed directly for pollution abatement in 1974.[205] Since then the number has probably increased because of the increased pollution abatement expenditures. The details of the NAS estimate are given in Table 31.

Table 31

Estimated Direct Employment in Pollution Control Activities, 1974[1]

Occupation	Federal	State	Local government	Industry	Educational institutions	Other	Total
Scientists	11,400	3,800	2,200	14,900	5,500	3,100	40,900
Engineers	8,300	5,200	5,700	64,700	1,300	8,800	94,000
Technicians	1,000	2,000	20,000	25,000	NA[2]	NA	48,000
Skilled operators	4,000	NA	155,000	112,000	NA	NA	271,000
Unskilled, clerical, other	4,000	3,000	147,000	67,000	NA	3,000	224,000
Total	28,700	14,000	329,900	283,600	6,800	14,900	677,900

[1] Excludes manpower in the fields of noise, radiation control, and pesticide application.

[2] NA = Not available.

Source: National Research Council, *Manpower for Environmental Pollution Control* (Washington, D.C., National Academy of Sciences, 1977), p. 48.

Table 32

Estimated Total Pollution Abatement Expenditures, 1976–85

(billion 1976 dollars)

	1976			1985			Cumulative (1976–1985)			
	Operation and maintenance	Capital costs [1]	Total annual costs [2]	Operation and maintenence	Capital costs [1]	Total annual costs [2]	Capital investment	Operation and maintenance	Capital costs [1]	Total annual costs [2]
Air pollution										
Public	0.1	0.1	0.2	0.6	0.2	0.8	2.0	4.3	1.9	6.2
Private										
Mobile [3]	3.4	2.0	5.4	0.8	7.5	8.3	52.5	18.4	53.8	72.2
Industrial	1.9	2.2	4.1	4.3	5.1	9.4	22.2	30.5	36.6	67.1
Utilities	1.2	1.2	2.4	4.0	4.0	8.0	19.9	24.9	24.9	49.8
Subtotal	6.6	5.5	12.1	9.7	16.8	26.5	96.6	78.1	117.2	195.3
Water pollution										
Public	2.6	7.7	10.3	6.4	15.3	21.7	63.3	44.3	120.4	164.7
Private										
Industrial	1.9	1.6	3.5	7.5	5.9	13.4	40.8	45.2	36.5	81.7
Utilities	.8	.5	1.3	1.5	.9	2.4	37.2	11.8	7.1	18.9
Subtotal	5.3	9.8	15.1	15.4	22.1	37.5	141.3	101.3	164.0	265.3
Radiation [3]										
Nuclear powerplant	<0.05	<0.05	<0.05	<0.05	<0.05	0.1	0.2	0.1	0.3	0.4
Solid wastes										
Public	2.0	0.3	2.3	2.2	0.8	3.0	4.9	21.2	4.9	26.1
Private	3.8	0.9	4.7	5.0	1.3	6.3	6.3	47.0	9.9	56.9
Subtotal	5.8	1.2	7.0	7.2	2.1	9.3	11.2	68.2	14.8	83.0
Land reclamation										
Surface mining	0.1	NA [4]	0.1	0.7	NA	0.7	NA	5.4	NA	5.4
Toxic substances [3]	NA	NA	NA	0.2	NA	0.2	NA	1.1	NA	1.1
Noise [3]	NA	NA	NA	0.4	0.4	0.8	2.7	1.8	2.0	3.8
Total	17.8	16.5	34.3	33.6	41.4	75.1	251.8	256.0	298.3	554.3

[1] Interest plus depreciation.
[2] Operation and maintenance costs plus capital costs.
[3] Incremental costs and total costs are assumed to be the same.
[4] NA = Not available.

CHAPTER REFERENCES

AIR QUALITY

1. Executive Office of the President, Energy Policy and Planning, *The National Energy Plan* (Washington, D.C.: Government Printing Office, 1977).
2. Federal Interagency Task Force on Air Quality Indicators: Council on Environmental Quality, U.S. Environmental Protection Agency, and U.S. Department of Commerce, *A Recommended Air Pollution Index* (Washington, D.C.: Government Printing Office, 1976).
3. L.D. Hollowell, R.J. Budnitz, and G.W. Traynor, *Combustion Generated Indoor Air Pollution* (Lawrence Berkeley Laboratory, University of California, 1976), LBL 5918.
4. For example, U.S. Department of Health, Education, and Welfare, *Air Quality Criteria for Carbon Monoxide* (Washington, D.C.: Government Printing Office, 1970), National Air Pollution Control Administration Pub. No. AP–62; N.A.T.O. Committee on the Challenges of Modern Society, *Air Quality Criteria for Carbon Monoxide* (Brussels, 1972), N. 10, available from Air Pollution Technical Information Center, Research Triangle Park, North Carolina.
5. John C. Trijonis, Ted K. Peng, Gregory L. McRae, and Lester Lees, *Emissions and Air Quality Trends in the South Coast Air Basin* (Pasadena: California Institute of Technology, 1976), EQL Memo No. 16.
6. For further details on the ozone projections, see Kay H. Jones, *CEQ Projections of Ozone Air Quality in 1990* (Springfield, Va.: National Technical Information Service, 1977).
7. Computed from tables in Environmental Protection Agency, "Mobile Source Emission Factors," Interim Document, June 1977.
8. Computed from data in U.S. Department of Transportation, U.S. Environmental Protection Agency, U.S. Federal Energy Administration, "An Analysis of Alternative Motor Vehicle Emission Standards," May 19, 1977, Table 2, p. 20.
9. Clean Air Act § 109 (c), as amended by Pub. L. 95–95, 91 Stat. 691, 42 U.S.C. § 7409 (1977).
10. U.S. Environmental Protection Agency, "Progress in the Prevention and Control of Air Pollution in 1976," undated, p. 11.
11. J.A.S. Adams, M.S.M. Mantovani, and L.L. Lundell, "Wood Versus Fossil Fuel as a Source of Excess Carbon Dioxide in the Atmosphere: A Preliminary Report," *Science* 196:54 (4285), April 1977.
12. C.D. Keeling and R.B. Barstow, "Impact of Industrial Gases on Climate," *Energy and Climate* (Washington, D.C.: National Academy of Sciences, 1977).
13. R.A. Bryson and G.J. Dittberner, "A Non-Equilibrium Model of Hemispheric Mean Surface Temperature," *J. Atmos. Sci.* 33:2103 (1976).
14. J. Mitchell, Jr., "A Preliminary Evaluation of Atmospheric Pollution as a Cause of the Global Temperature Fluctuation of the Past Century," in S.F. Singer (ed.), *Global Effects on Environmental Pollution* (New York: Springer Verlag, 1970), pp. 139-59.
15. M.J. Molina and F.S. Rowland, "Stratospheric Sink for Chlorofluoromethanes: Chlorine Atom Catalyzed Destruction of Ozone," *Nature* 249:810–12 (1974).
16. Federal Task Force on Inadvertent Modification of the Stratosphere (IMOS), *Fluorocarbons and the Environment* (Washington, D.C.: Government Printing Office, 1975), pp. iii–3.
17. National Research Council, Assembly of Mathematical and Physical Sciences, Panel on Atmospheric Chemistry, *Halocarbons: Effects on*

Stratospheric Ozone (Washington, D.C.: National Academy of Sciences, 1976), p. 3.

18. National Research Council, Assembly of Mathematical and Physical Sciences, Committee on Impacts of Stratospheric Change, *Halocarbons: Environmental Effects of Clorofluoromethane Release* (Washington, D.C.: National Academy of Sciences, 1976).
19. J. Scotto, T.R. Fears, and G.B. Gori, *Measurements of Ultraviolet Radiation in the United States and Comparisons with Cancer Data* (Washington, D.C.: Government Printing Office, 1976), DHEW Pub. NIH 76–1029, pp. 1–3.10.
20. National Research Council, *supra* note 18, at 86.
21. The research program, called BACER (Biological and Climatic Effects Research), is being coordinated by EPA.
22. S. Oden, "The Acidity Problem: An Outline of Concepts," in U.S. Department of Agriculture, Forest Service, *Proceedings of the First International Symposium on Acid Precipitation and the Forest Ecosystem*, General Technical Report NE–23 (Upper Darby, Pa.), p. 9; C.V. Cogbill, and G.E. Likens, "Acid Precipitation in the Northeastern United States," *Water Resources Research* 10 (6):1133–37 (1974).
23. Royal Ministry for Foreign Affairs, Royal Ministry of Agriculture, "Air Pollution across National Boundaries: The Impact on the Environment of Sulfur in Air and Precipitation," Sweden's Case Study for the United States Conference on the Human Environment, Stockholm, 1972.
24. S. Oden, *supra* note 22.
25. Royal Ministry for Foreign Affairs, *supra* note 23.

WATER QUALITY

26. Federal Water Pollution Control Act Amendments, Pub. L. 92–500, 86 Stat. 816, 33 U.S.C. § 1251 (1972).
27. Thomas C. Jorling, Assistant Administrator for Water and Hazardous Materials, U.S. Environmental Protection Agency, *Hearings Before the Senate Subcommittee on Environmental Pollution of the Committee on Environment and Public Works*, Part 9, June 30, 1977, 95th Cong., 1st Sess. (Washington, D.C.: Government Printing Office, 1977), p. 620.
28. *Ibid.*
29. U.S. Environmental Protection Agency, *National Water Quality Inventory: 1976 Report to Congress* (Washington, D.C.: Government Printing Office, 1977), EPA 440/9–76–024, p. 16.
30. *Id.* p. 21.
31. *Id.* p. 22.
32. *Ibid.*
33. *Id.* p. 24.
34. Interpretation of NASQAN data is discussed on pages 261–68 of the Council's 1976 Annual Report.
35. U.S. Environmental Protection Agency, *Quality Criteria for Water* (Washington, D.C., 1976), EPA–440/9–76–023, p. 79.
36. National Academy of Sciences-National Academy of Engineering, Environmental Studies Board, Committee on Water Quality Criteria, *Water Quality Criteria 1972* (Washington, D.C.: Government Printing Office, 1974), p. 58.
37. U.S. Geological Survey, press release, April 25, 1977.
38. Thomas C. Jorling, *supra* note 27, at 3.
39. G.K. Young, D. Evans, R.U. Jettmar, *Analysis of Oil Spill Trends*, prepared for the Council on Environmental Quality and the U.S. Environmental Protection Agency by GKY and Associates under Contract No. EQ6AC014 (Springfield, Va.: National Technical Information Service, 1976), PB–260 917, p. 1.

40. G.K. Young, L.S. Warner, and R.U. Jettmar, *Major Oil Spills from Tankers and Barges and Other Vessels in U.S. Waters—Analysis of Recent Trends and Patterns,* prepared for the Council on Environmental Quality by GKY and Associates under Contract No. EQ7AD239 (Springfield, Va.: National Technical Information Service, 1977), PB–268 515, p. 6.
41. *Id.* pp. 2–3.
42. Rachel Carson, *Silent Spring* (Boston: Houghton Mifflin Co., 1962).
43. National Academy of Sciences, *Pest Control: An Assessment of Present and Alternative Technologies,* Vol. 1, *Contemporary Pest Control Practices and Prospects: The Report of the Executive Committee* (Washington, D.C., 1975), p. 11.
44. R. von Rumker, E.W. Lawless, and A.F. Meiners, *Production, Distribution, Use and Environmental Impact Potential of Selected Pesticides,* prepared for the U.S. Environmental Protection Agency and the Council on Environmental Quality (Washington, D.C., 1974), EPA 540/1-74-001, p. 23.
45. National Academy of Sciences, *supra* note 43, at 260, 263, 265.
46. P.A. Andrilenas, *Farmers' Use of Pesticides in 1971—Quantities,* U.S. Department of Agriculture, Economic Research Service, Agricultural Economic Report 252 (Washington, D.C.: Government Printing Office, 1974), pp. 42, 40, 52.
47. R. von Rumker, et al., *supra* note 44, at 10; R. von Rumker, R.M. Matter, D.P. Clement, and F.K. Erikson, *The Use of Pesticides in Suburban Homes and Gardens and Their Impact on the Aquatic Environment* (Washington, D.C.: Government Printing Office, 1972), p. 8.
48. *National Water Quality Inventory, supra* note 29, at 30–35.
49. *Id.* p. 32.

ENVIRONMENTAL HEALTH

50. John Snow, *Snow on Cholera* (New York: Hafner Publishing Company, 1934).
51. A.E. Gorman and A. Wohlman, "Waterborne Outbreaks in the United States and their Significance," *Journal AWWA* 31(2):255 (1939); G.F. Craun and L.J. McCabe, "Review of the Causes of Waterborne-Disease Outbreaks," *Journal AWWA* 65(1):74-84 (1973).
52. A.S. Benenson, ed., *Control of Communicable Diseases in Man, 11th edition* (New York: American Public Health Association, 1970); J.A. Salvato, *Environmental Sanitation* (New York: John Wiley and Sons, 1958), p. 15.
53. U.S. Department of Health, Education and Welfare, National Center for Health Statistics, *Vital Statistics of the United States: 1970,* Vol. II, *Mortality,* Part A, Section 1.
54. U.S. Environmental Protection Agency, Office of Toxic Substances, *Preliminary Assessment of Suspected Carcinogens in Drinking Water: Interim Report to Congress* (Washington, D.C., 1975), pp. 37–38.
55. Pub. L. 93-523, 88 Stat. 1660, 42 U.S.C. § 300(f) *et seq.*
56. U.S. Department of Health, Education and Welfare, *supra* note 53.
57. Jun Kobayashi, "On Geographical Relationship Between the Chemical Nature of River Water and Death Rate from Apoplexy," *Berichte des Ohara Institute F. Landwirtsch Biologie* 11:12-21 (1957).
58. P.E. Enterline and W.H. Stewart, "Geographic Patterns in Deaths from Coronary Heart Disease," *Public Health Reports* 71(a):849-55 (1956).
59. L.C. Neri, D. Hewitt, and G.B. Schreiber, "Can Epidemiology Elucidate the Water Story?" *Am. J. Epid.* 99(2):75-88 (1974); S. Heyden, "The Hard Facts Behind the Hard-Water Theory and Ischemic Heart Disease," *J. Chron. Dis.* 29:149–57 (1976).

60. S. Punsar et al., "Coronary Heart Disease and Drinking Water: A Search in Two Finnish Male Cohorts for Epidemiologic Evidence of a Water Factor," *J. Chron. Dis.* 28:259-87 (1975).

61. Letter from H. Yellowlees, Chief Medical Officer, U.K. Department of Health and Social Security, to R.H. Harris, Director, Toxic Chemicals Program, Environmental Defense Fund, reproduced in "Comments by the Environmental Defense Fund on the Interim Primary Drinking Water Standards," April 25, 1975, Attachment 10.

62. National Academy of Sciences, *Summary Report: Drinking Water and Health* (Washington, D.C., 1977), pp. 42–43.

63. M.A. Ibrahim and R.F. Christman, "Drinking Water and Carcinogenesis: The Dilemmas," *Amer. J. Public Health* 67(8):719 (1977).

64. U.S. Department of Health, Education, and Welfare, *supra* note 53.

65. R. Masironi, "Cardiovascular Mortality in Relation to Radioactivity and Hardness of Local Water Supplies in the U.S.A.," *Bulletin WHO* 43:687 (1970).

66. M.J. Taras et al., eds., *Standard Methods for the Examination of Water and Wastewater: Thirteenth Edition* (New York: American Public Health Association, American Public Works Association, Water Pollution Control Federation, 1971), pp. 178-84.

67. National Technical Advisory Committee to the Secretary of the Interior, *Water Quality Criteria* (Washington, D.C.: Government Printing Office, 1968), p. 41; National Academy of Sciences, *Water Quality Criteria* (Washington, D.C.: Government Printing Office, 1972).

68. M.D. Crawford, J.J. Gardner, and J.N. Morris, "Mortality and Hardness of Local Water Supplies," *Lancet* 1:827-31 (1968).

69. L.C. Neri et al., "Health Aspects of Hard and Soft Waters," *Journal AWWA* 67(8): 403-409 (1975).

ENERGY

70. This section on Energy Conditions and Trends constitutes the Council's third yearly report on the environmental consequences of the development and application of energy technologies, as required under Section 11 of the Federal Nonnuclear Energy Research and Development Act of 1974.

71. Amory B. Lovins, "Energy Strategy: The Road Not Taken?" *Foreign Affairs* 55(1):65. See also Amory B. Lovins, *Soft Energy Paths: Toward a Durable Peace* (Cambridge, Mass.: Ballinger Publishing Co., 1977); U.S. Congress, Senate Committee on Interior and Insular Affairs, *Alternative Long-Range Energy Strategies*, 94th Cong., 2d Sess., December 9, 1976.

72. Charles Yulish, ed., *Soft vs. Hard Energy Paths* (New York: Charles Yulish Associates, 1977).

73. Based on Energy Research and Development Administration, *A National Plan for Energy Research, Development and Demonstration: Creating Energy Choices for the Future* (*ERDA-48*) (Washington, D.C.: Government Printing Office, 1975), Appendix B.

74. Amory B. Lovins, *supra* note 71, at 67.

75. Denis Hayes, *Energy: The Case for Conservation*, World Watch Paper No. 4 (Washington, D.C., 1976), p. 23.

76. Amory B. Lovins, *supra* note 71, at 68-72.

77. Gerald O. Barney, ed., *The Unfinished Agenda* (New York: Thomas Y. Crowell Co., 1977), p. 61.

78. J. Peschon, L. Isaksen, and L.C. Markel, "Regulatory Approaches for Handling Reliability and Reserve Margin Issues and Impacts on Reserve Margin of Dispersed Storage and Generation Systems," Systems Controls, Inc., Palo Alto, 1976.

79. The Mitre Corporation, "Need for Power (NFP) Study," interim report, prepared for the Energy Research and Development Administration, Office of Program Integration, 1977.

80. Jim Harding, California Energy Resources, Conservation, and Development Commission, "Yardsticks of Power System Planning," memorandum, March 30, 1977, p. 5, note 6.

81. Statement by Edward P. Kahn before the New Jersey Board of Public Utility Commissions, Docket No. 762-194.

82. Wisconsin Public Service Commission, *Assessment of the 1976 Plan for Future Electric Power Facilities* (Madison: Wisconsin Public Service Commission, 1977).

83. Executive Office of the President, Energy Policy and Planning, *The National Energy Plan* (Washington, D.C.: Government Printing Office, 1977).

84. Minnesota Energy Agency, Director's Decision, Docket No. EA-77-001-WS.

85. A. Hammond, "Photovoltaics: The Semiconductor Revolution Comes to Solar," *Science* 197:445 (1977); W. Metz, "Solar Thermal Energy: Bringing the Pieces Together," *Science* 197:650 (1977); A. Hammond, "An International Partnership for Solar Power," *Science* 197:623 (1977).

86. U.S. Congress, Office of Technology Assessment, "Application of Solar Technology to Today's Energy Needs," prepublication draft, June 1977.

87. BDM Corp., "DOD Photovoltaic Energy Conversion Systems Market Inventory and Analysis," prepared for the Department of Defense and the Federal Energy Administration, 1977.

88. U.S. Energy Research and Development Administration, *A National Plan for Energy Research, Development, and Demonstration* (Washington, D.C.: Government Printing Office, 1977), p. 40.

89. See Stewart W. Herman and James S. Cannon, *Energy Futures: Industry and the New Technologies* (New York: Inform, Inc., 1976), which details the technological status of emerging energy systems, with particular emphasis on the commercial and institutional barriers to their introduction.

90. Based on U.S. Department of the Interior, "Annual U.S. Energy Use Up in 1976," press release, March 14, 1977, p. 4.

91. Executive Office of the President, *supra* note 83, p. 101.

92. The Dow Chemical Co.; Environmental Research Institute of Michigan; Townsend-Greenspan and Company, Inc.; and Cravath, Swaine, and Moore, *Energy Industrial Center Study*, prepared for the National Science Foundation under Contract No. OE P74-20242 (1975). See also Charles Berg, written statement for the California State Energy Resources Conservation and Development Commission, February 7, 1977.

93. Thomas F. Widmer, *Summary Assessment of Electricity Cogeneration in Industry*, prepared by Thermo Electron Corporation, Waltham, Massachusetts, March 15, 1977.

94. Ronald K. White and Richard L. Green, "Cogeneration in West Germany," letter, *Science* 197:618 (1977).

95. Thomas F. Widmer, *supra* note 93.

96. Letter from Robert H. Williams and Frank von Hippel, Center for Environmental Studies, Princeton University, November 27, 1976.

97. See J. Karkcheck, J. Powell, and E. Beardsworth, "Prospects for District Heating in the United States," *Science* 195:948 (1977); Swedish Export Council, *Combined District Heating and Power Generation*, 2d ed. (Stockholm: July 1976); Neil Muir, *District Heating in Sweden* (Finspong: STAL-LAVAL Turbin AB, 1973).

98. Kjell Larsson, "District Heating: Swedish Experience of an Energy Efficient Concept," 1977, p. 23.
99. Exxon Research and Engineering Co., "Evaluation of the Feasibility for Widespread Introduction of Coal into the Residential and Commercial Sectors," draft, prepared for the Council on Environmental Quality under Contract No. EQ6AC029, 1977, pp. 8-24 to 8-28.
100. *Id.* pp. 8-20, 8-24.
101. U.K. Department of Energy, *District Heating Combined with Electricity Generation in the United Kingdom*, Energy Paper No. 20 (London: Her Majesty's Stationery Office, 1977).
102. Charles A. Berg, "Energy Conservation Through Efficient Utilization," *Science* 181:128, 129 (1973).
103. Richard Schoen, Alan S. Hirshberg, and Jerome M. Weingart, *New Energy Technologies for Buildings* (Cambridge, Massachusetts: Ballinger Publishing Co., 1975), p. 33.
104. See New England Federal Regional Council, "A Report on New England Hydroelectric Development Potential," prepared for the Federal Energy Administration (1976); Rhode Island State Energy Office, "Hydroelectric Study—Interim Progress Report" (1976); David E. Lilienthal, "Energy from Waters," *New York Times*, December 28, 1976, p. 27.
105. Energy Research and Applications, Inc., "A Study to Determine the Resource Potential and Application of Aqua Solar Energy in the U.S.," proposal to the Electric Power Research Institute, September 1976, title page.
106. *Ibid.*
107. Philip R. Vance, *Regional Hydroelectric Reclamation* (Bedford, Mass.: The Mitre Corporation, 1976), p. 13.
108. Executive Office of the President, *supra* note 83.
109. Letter from David R. Campbell, Hydraulic Engineer, New England Power Service Company, Westborough, Massachusetts, to Jacques Gros, Council on Environmental Quality, February 16, 1977.
110. ICF, Inc., "An Assessment of Unconventional Energy Technologies," prepared for the Council on Environmental Quality under Contract No. EQ6AC028, draft, 1977, p. 41.
111. Fritz R. Kalhammer and Thomas R. Schneider, "Energy Storage," in Jack M. Hollander, ed., *Annual Review of Energy*, Vol. 1, pp. 311-43 (Palo Alto: Annual Reviews, Inc., 1976).
112. University of Oklahoma, *Energy Alternatives: A Comparative Analysis*, prepared for the Council on Environmental Quality and other federal agencies under Contract No. EQ4AC034 (Washington, D.C.: Government Printing Office, 1975), p. 11-3.
113. Energy Research and Development Administration, *Solar Program Assessment: Environmental Factors—Photovoltaics* (Washington, D.C.: Government Printing Office, 1977), 44.
114. University of Oklahoma, *supra* note 112, at p. I-51, Table I-18.
115. Richard S. Caputo, "Solar Power Plants: Dark Horse in the Energy Stable," *The Bulletin of the Atomic Scientists* 33(5):46, 48 (1977).
116. U.S. Energy Research and Development Administration, *Solar Program Assessment: Environmental Factors—Solar Thermal Electric*, ERDA 77-74/4 (Washington, D.C.: Government Printing Office, 1977), p. 2.
117. Booz-Allen and Hamilton, Inc., "A Policy Assessment of Solar Heating and Cooling for Buildings—Draft," prepared for the Council on Environmental Quality under Contract No. EQ6AC027, 1977.
118. *Id.* p. III-11.
119. Allan Poole and Robert Williams, "Flower Power: Prospects for Photosynthetic Energy," *The Bulletin of the Atomic Scientists* 32(5):48 (1976).
120. *Id.* p. 49.

121. David Pimentel, Cornell University, "Biomass Energy Conversion: Ecological, Economic, and Social Constraints," draft, October 29, 1976, p. 9.
122. Arjun Makhijani and Alan Poole, *Energy and Agriculture in the Third World* (Cambridge, Mass.: Ballinger Publishing Co., 1975), pp. 101–111, 143–60.
123. National Academy of Sciences, *Energy for Rural Development*, prepared for the Agency for International Development under Contract No. AID/csd-2584 (Washington, D.C., 1976), pp. 44-45, 180-90.
124. Allen L. Hammond, "Alcohol: A Brazilian Answer to the Energy Crisis," *Science* 195:564 (1977).
125. Alan Poole and Robert Williams, *supra* note 119, at 51.
126. *Id.* pp. 52-53.
127. *Id.* p. 55.

NONRENEWABLE RESOURCES

128 Earl T. Hayes, "Energy Implications of Materials Processing," *Science* 191:664 (1976).
129. John P. Albers, Walter J. Bawiec, and Lawrence F. Rooney, *Demand and Supply of Nonfuel Minerals and Materials for the United States Energy Industry, 1975–90—A Preliminary Report* (Washington, D.C.: Government Printing Office, 1976), Geological Survey Professional Paper 1006–A, B, pp. B7–B37.
130. *Id.* p. B32.
131. T. S. Lovering, in National Academy of Sciences and National Research Council, *Resources and Man* (San Francisco: W. H. Freeman and Co., 1969), p. 12, cited in Hayes, *supra* note 128, at 664.
132. National Commission on Supplies and Shortages, *Government and the Nation's Resources* (Washington, D.C.: Government Printing Office, 1976), pp. ix-x.
133. U.S. Department of the Interior, *Mining and Minerals Policy, 1973, Appendices* (Washington, D.C.: Government Printing Office, 1973), and unpublished data; see also Council on Environmental Quality, *Environmental Quality—1974: The Fifth Annual Report of the Council on Environmental Quality* (Washington, D.C.: Government Printing Office, 1974), p. 311.
134. See Richard A. Carpenter, "Tensions Between Materials and Environmental Quality," *Science* 191:665-68 (1976).
135. National Commission on Supplies and Shortages, *supra* note 132, at 22-23.
136. Philip H. Abelson and Allen L. Hammond, "The New World of Materials," *Science* 191:633 (1976).
137. National Commission on Supplies and Shortages, *supra* note 132, at 37.
138. U.S. Department of the Interior, *Mining and Minerals Policy: 1976 Bicentennial Edition* (Washington, D.C.: Government Printing Office, 1976), p. 3.
139. U.S. Department of the Interior, Bureau of Mines, *Mineral Facts and Problems: 1975 Edition* (Washington, D.C.: Government Printing Office, 1975), Bulletin 667, Figure 12, p. 9.
140. Hans H. Landsberg, "Materials: Some Recent Trends and Issues," *Science* 191:637 (1976).
141. *Ibid.*
142. *Mineral Facts and Problems*, *supra* note 139, Figure 15, p. 11.
143. S. Victor Radcliffe, "World Changes and Chances: Some Perspectives for Materials," *Science* 191:704 (1976).
144. U.S. Department of the Interior, Bureau of Mines, *Mineral Yearbook: 1974*, Vol. III, *Area Reports: International* (Washington, D.C.: Government Printing Office, 1976), p. 1194.
145. *Mineral Facts and Problems*, *supra* note 139, p. 244.

146. U.S. Department of the Interior, Bureau of Mines, "Mineral Industry Surveys: Chromium, Monthly," for December 1975 (Washington, D.C., February 25, 1976), pp. 5-6.
147. *Id.* for December 1976 (March 4, 1977), pp. 5-6.
148. Information supplied by Kenneth Palmer, Division of Ferrous Metals, Bureau of Mines, U.S. Department of the Interior.

POPULATION AND HUMAN SETTLEMENTS

149. U.S. Department of Commerce, Bureau of the Census, *Current Population Reports*, Series P-25, No. 647, "Estimates of the Population of the United States to January 1, 1977" (Washington, D.C.: Government Printing Office, 1977).
150. U.S. Department of Health, Education, and Welfare, National Center for Health Statistics, "Births, Marriages, Divorces, and Deaths for 1976," *Monthly Vital Statistics Report* 25 (12):1 (1977).
151. U.S. Department of Commerce, Bureau of the Census, *Current Population Reports*, Series P–23, No. 56, "Coverage of the Population in the 1970 Census and Some Implications for Public Programs" (Washington, D.C.: Government Printing Office, 1975).
152. Lesko Associates, Inc., *Basic Data and Guidance Required to Implement a Major Illegal Alien Study during Fiscal Year 1976*, prepared for the U.S. Department of Justice, Immigration and Naturalization Service under Contract No. CO-16-75 (Washington, D.C., 1975), p. 16.
153. U.S. Department of Health, Education, and Welfare, National Center for Health Statistics, "Advance Report: Final Natality Statistics for 1975," *Monthly Statistics Report* 25 (Supplement to 10):1 (1976).
154. *Monthly Vital Statistics Report, supra* note 150.
155. *Ibid.*; U.S. Department of Commerce, Bureau of the Census, *Current Population Reports*, Series P-25, No. 643, "Estimates of the Population of the United States, by Age, Sex, and Race, July 1, 1974 to 1976" (Washington, D.C.: Government Printing Office, 1977).
156. Planned Parenthood Federation of America, *Family Planning Perspectives* 9(1):4-11 (1977).
157. Charles F. Westoff, "The Decline of Unplanned Births in the United States," *Science* 191:38-41 (1976).
158. Immigration and Nationality Act Amendments of 1976, Pub L. 94–571, 90 Stat. 2703, 8 U.S.C. §§ 1101 and 1151.
159. U.S. Department of Commerce, Bureau of the Census, *Current Population Reports*, Series P-20, No. 305, "Geographical Mobility" (Washington, D.C.: Government Printing Office, 1977), p. 1.
160. *Ibid.*
161. Brian J.L. Berry and Donald C. Dahmann, *Population Redistribution in the United States in the 1970's* (Washington, D.C: National Academy of Sciences, 1977), p. 22.
162. *Id.* pp. 31, 33.
163. *Id.* p. 12.
164. Ray Marshall and Allen Thompson, *Status and Prospects of Small Farmers in the South* (Atlanta: Southern Regional Council, Inc., 1976), p. 23.
165. U.S. Domestic Council, *Report on National Growth and Development: The Changing Issues for National Growth* (Washington, D.C.: Government Printing Office, 1976), p. 23. Updated through 1975 with data from U.S. Department of Commerce, Bureau of the Census, *Current Population Reports*, Series P-20, No. 292.
166. Population Reference Bureau, Inc., "Chronology of Major Population Related Events in 1976," *PRB Report* 3(1):2 (1977).

167. U.S. Department of Commerce, Bureau of the Census, *World Population: 1975* (Washington, D.C.: Government Printing Office, 1976), p. 9.

168. United Nations Fund for Population Activities, *UNFPA Newsletter* No. 25, March 1977, p. 1.

169. United Nations Fund for Population Activities, *1975 Report of the Executive Director of the United Nations Fund for Population Activities* (New York: United Nations, 1976), Appendix A, p. 56.

170. United Nations Fund for Population Activities, *1976 Report of the Executive Director of the United Nations Fund for Population Activities* (New York: United Nations, 1977), Appendix A, p. 71.

171. Lydia Giffler, Office of Economic Research and Analysis, U.S. Department of State, Memorandum to Horace W. Hunter, October 25, 1977, Attachment I.

172. George J. Beier, "Can Third World Cities Cope?" *Population Bulletin* 31(4):3, 4 (1976).

173. U.S. Congress, House, *Ninth Annual Report on the National Housing Goal*, House Doc. 53, 95th Cong., 1st Sess., 1977, p. 12.

174. U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States: 1976* (Washington, D.C.: U.S. Government Printing Office, 1976), pp. 5, 41.

175. *Ninth Annual Report on the National Housing Goal, supra* note 173, at 41.

176. Housing and Community Development Act of 1974, Pub. L. 93–383, 88 Stat. 662, 42 U.S.C. § 1437f (1974).

177. *Ninth Annual Report on the National Housing Goal, supra* note 173, at 7.

178. *Id.* p. 64.

179. *Id.* p. 7.

180. *Id.* p. 9.

181. *Ibid.*

182. U.S. Department of Commerce, Bureau of the Census, and U.S. Department of Housing and Urban Development, *Annual Housing Survey: 1975*, Part B, *Indicators of Housing and Neighborhood Quality* (Washington, D.C.: Government Printing Office, 1977), pp. 12–14.

183. Act of October 15, 1966, Pub. L. 89–655, 80 Stat. 915, 16 U.S.C. §470a (1966).

184. U.S. Department of the Interior, Office of Archaeology and Historic Preservation, "District Study," 1977.

185. Pub. L. 93–383, 88 Stat. 633 (codified in scattered sections of 5, 12, and 42 U.S.C.).

186. National Trust for Historic Preservation, *A Guide to Federal Programs for Historic Preservation, 1976 Supplement* (Washington, D.C.: The Preservation Press, 1976).

187. U.S. Department of the Interior, *A Preliminary Urban Parks Study* (Washington, D.C., 1977).

188. *Id.* p. 11.

189. Land and Water Conservation Fund Act of 1965, Pub. L. 88–578, Title I, § 2, 78 Stat. 892, 16 U.S.C. § 4601–5.

190. U.S. Department of the Interior, Bureau of Outdoor Recreation, "Grants in Aid by FY and SMSA Type," October 13, 1977.

191. Pub. L. 94–422, 90 Stat. 1318, 16 U.S.C. § 4601(1)–10d (1976).

192. Pub. L. 94–386, 44 Stat. 741, 43 U.S.C. § 869 (1976).

ECONOMICS

193. U.S. Department of Commerce, Bureau of Economic Analysis, "Pollution Abatement and Control Expenditures, 1974," *Survey of Current Business* 57(2):15 (1977).

194. Data provided by the Office of Management and Budget.
195. U.S. Environmental Protection Agency memorandum, "Impacts of the Automobile Program," William Drayton to Michael Blumenthal, April 28, 1977.
196. U.S. Environmental Protection Agency, "A Preliminary Analysis of the Economic Impact of the Electric Utility Industry of Alternate Approaches to Significant Deterioration" (Washington, D.C., February 5, 1976), pp. V-6, V-7.
197. Kearney Management Consultants, "Economic Impact Analysis of EPA Regulations on the Automotive Industry, Part II—The Costs of Emissions Reduction," draft, prepared for the Environmental Protection Agency under Contract No. 68-01-4328 (Washington, D.C., July 1977), p. IV-11.
198. Preliminary estimates provided by U.S. Environmental Protection Agency, Office of Planning and Evaluation.
199. U.S. Environmental Protection Agency, *supra* note 197, at V-8.
200. U.S. General Accounting Office, "A Comparison of Three Estimates of Costs of the Proposed Toxic Substances Control Act," prepared for the Senate Committee on Commerce, Subcommittee on Environment (October 21, 1975).
201. ICF, Inc., *Energy and Economic Impacts of H.R. 13950,* prepared for the Council on Environmental Quality and the U.S. Environmental Protection Agency under Contract No. EQ6AC016 (Springfield, Va.: National Technical Information Service, 1977).
202. Chase Econometrics, Inc., "The Macroeconomic Impacts of Federal Pollution Control Programs: 1976 Assessment," prepared for the Council on Environmental Quality and the U.S. Environmental Protection Agency under Contract No. EQ6AC015 (1976).
203. U.S. Environmental Protection Agency, "1977 First Quarter Report of the Economic Dislocation Early Warning System" (Washington, D.C., July 29, 1977), and "1976 First Quarter Report" (Washington, D.C., May 21, 1976).
204. Chase Econometrics, *supra* note 202.
205. National Research Council, *Manpower for Environmental Pollution Control,* Vol. V, *Analytical Studies for the U.S. Environmental Protection Agency* (Washington, D.C., National Academy of Sciences, 1977).

APPENDIX A

THE PRESIDENT'S MESSAGE ON THE ENVIRONMENT AND EXECUTIVE ORDERS

The Environment:
The President's Message to the Congress

To the Congress of the United States:

This message brings together a great variety of programs. It deals not only with ways to preserve the wilderness, wildlife, and natural and historical resources which are a beautiful and valued part of America's national heritage: it deals also with the effects of pollution, toxic chemicals, and the damage caused by the demand for energy. Each of these concerns, in its own way, affects the environment; and together they underscore the importance of environmental protection in all our lives.

Americans long thought that nature could take care of itself—or that if it did not, the consequences were someone else's problem. As we know now, that assumption was wrong: none of us is a stranger to environmental problems.

Industrial workers, for example, are exposed to disproportionate risks from toxic substances in their surroundings. The urban poor, many of whom have never had the chance to canoe a river or hike a mountain trail, must nevertheless endure each day the hazardous effects of lead and other pollutants in the air.

I believe environmental protection is consistent with a sound economy. Previous pollution control laws have generated many more jobs than they have cost. And other environmental measures whose time has come—measures like energy conservation, reclamation of stripmined lands, and rehabilitation of our cities—will produce still more new jobs, often where they are needed most. In any event, if we ignore the care of our environment, the day will eventually come when our economy suffers for that neglect.

Intelligent stewardship of the environment on behalf of all Americans is a prime responsibility of government. Congress has in the past carried out its share of this duty well—so well, in fact, that the primary need today is not for new comprehensive statutes but for sensitive administration and energetic enforcement of the ones we have. Environmental protection is no longer just a legislative job, but one that requires—and will now receive—firm and unsparing support from the Executive Branch.

In this spirit, I am presenting the following program to build upon Congress' admirable record:

Actions to control pollution and protect health

- A coordinated attack on toxic chemicals in the environment
- Effective implementation of the Toxic Substances Control Act
- Accelerated development of occupational health standards to protect workers
- Strong legislation to improve air quality
- A $45 billion, 10-year program to build sewage facilities
- Accelerated study of economic incentives to encourage recycling

Actions to assure environmentally sound energy development

- Support for amendments to improve the Outer Continental Shelf Lands Act
- Revision of the OCS leasing schedule
- More participation by states in the current OCS program
- Accelerated identification of health and environmental effects of new energy technologies
- A nationwide evaluation of the availability of water for energy development
- Support for strong national stripmining legislation
- Reform of the federal coal leasing program

Actions to improve the urban environment

- Commitment to neighborhood preservation and conservation
- Use of historic buildings for federal offices where appropriate
- An improved and expanded urban homesteading program

Actions to protect our natural resources

- A comprehensive review of water resources policy
- Executive Orders to direct federal agencies to refrain from supporting development in floodplains and wetlands
- Support for the program regulating dredge spoil disposal in wetlands
- $50 million over the next five years to purchase wetlands to protect waterfowl habitat
- Development of legislation to replace the anachronistic Mining Law of 1872 with one that establishes a leasing system for hardrock minerals
- A comprehensive review of the Cooperative Forestry Program
- An Executive Order strengthening protection of public lands from the uncontrolled use of off-road vehicles

Actions to preserve our national heritage

- An accelerated five-year, $759 million program to develop new and existing parks
- Development of legislation to establish a National Heritage Trust to protect places of cultural, historic, and ecological value
- Support for designating major additions to the Park, Forest, Wildlife Refuge, and Wild and Scenic River Systems in Alaska
- Four new wilderness proposals and enlargement of five others submitted by previous Administrations
- Accelerated preparation of new wilderness proposals for Alaska and the East and initiation of a vigorous new wilderness program on Bureau of Land Management lands
- Eight new Wild and Scenic Rivers and proposals to study 20 others
- Legislation to deauthorize the Cross Florida Barge Canal and to study adding the Oklawaha River to the Wild and Scenic River System
- Three new National Scenic Trails

Actions to protect wildlife

- A $295 million five-year program to rehabilitate and improve the Wildlife Refuge System
- Improved protection for nongame wildlife
- An accelerated effort to identify habitat critical to the survival and recovery of endangered species
- An Executive Order restricting the introduction of potentially harmful foreign plants and animals into the United States

Actions which affirm our concern for the global environment

- A major interagency study to assess potential global environmental changes and their impact on the United States
- An offer to assist interested nations in dealing with population problems

- Inclusion of environmental considerations in assistance programs of the Agency for International Development
- Support for a number of international environmental agreements
- A prohibition on commercial whaling in the U.S. 200-mile fisheries zone

Actions to improve implementation of environmental laws

- An Executive Order directing the Council on Environmental Quality to issue regulations reducing paperwork in the environmental impact statement process
- Development of legislation to create one consolidated environmental grant program
- A review of environmental coordination legislation to reduce overlapping and conflicting requirements.

I. POLLUTION AND HEALTH

At the beginning of this decade, the United States embarked on a long overdue program to reduce pollution and make our environment healthier and more livable. My Administration fully supports the progressive legislation that has been enacted. We are particularly committed to strong measures to protect our most important resource—human health—from the increasingly apparent problem of hazardous substances in the environment.

- We plan to improve enforcement of our pollution control laws.
- We intend to make increased use of economic incentives to achieve our environmental goals.
- We will seize opportunities to reduce pollution by conserving resources.
- We will work with state and local governments to make sure that the job of controlling pollution is properly planned and does not stop with the promulgation of regulations in Washington.
- We will make every effort to see that regulation of a problem in one medium—such as water—does not create new environmental problems in another medium—such as air.
- And we will squarely face emerging environmental problems so that they can be dealt with effectively without an atmosphere of crisis.

TOXIC CHEMICALS

The presence of toxic chemicals in our environment is one of the grimmest discoveries of the industrial era. Rather than coping with these hazards after they have escaped into our environment, our primary objective must be to prevent them from entering the environment at all.

At least a dozen major federal statutes, implemented by seven different agencies, address this problem in various ways. With the enactment last year of the Toxic Substances Control Act, no further comprehensive federal legislation should be necessary. Now we must inaugurate a coordinated federal effort to exclude these chemicals from our environment.

I am therefore instructing the Council on Environmental Quality to develop an interagency program (1) to eliminate overlaps and fill gaps in the collection of data on toxic chemicals, and (2) to coordinate federal research and regulatory activities affecting them.

The Toxic Substances Control Act enables the federal government, for the first time, to gather the information on chemical substances needed to determine their potential for damaging human health and the environment, and to control them where necessary to protect the public. My FY 1978 budget provides nearly $29 million—a threefold increase over Fiscal 1977—for the Environmental Protection Agency to implement this important Act.

I have instructed the Environmental Protection Agency to give its highest priority to developing 1983-best-available-technology industrial effluent standards which will control toxic pollutants under the Federal Water Pollution Control Act, and to incorporate these standards into discharge permits. My Administration will be seeking amendments to this Act, including revision of Section 307(a), to permit the Environmental Protection Agency to move more decisively against the discharge of chemicals potentially injurious to human health.

Finally, I have instructed the Environmental Protection Agency to set standards under the Safe Drinking Water Act which will limit human exposure to toxic substances in drinking water, beginning with potential carcinogens.

THE WORKPLACE

Each year, environmental hazards in the workplace cause at least 390,000 new cases of disease and perhaps as many as 100,000 deaths. Regulation of toxic chemicals will reduce this toll, but other steps are also necessary to protect worker health and to assure adequate compensation to those who suffer from occupational diseases.

In the past, implementation of the Occupational Safety and Health Act of 1970 has emphasized safety and too often resulted in unnecessary and burdensome regulations. Yet at the same time the federal response to health problems has been unconscionably slow. Under my Administration OSHA will develop and enforce effective standards for occupational health without repeating the excesses of the past. We will continue to work with the Congress to strengthen the Coal Mine Health and Safety Act and the Metallic and Nonmetallic Mine Safety Act, and we are now implementing administrative reforms to improve standard-setting procedures, enforcement, and penalty collection.

In addition, my Administration will explore and develop proposals to supplement federal occupational health regulations, and will examine the full range of reforms that might be undertaken by the appropriate levels of government to assure adequate compensation for occupationally-induced diseases.

AIR POLLUTION

Clean air is essential to the health and welfare of all Americans. Although we have made considerable progress, much remains to be done before we have fully achieved our ambient air quality goals.

My Administration has already submitted to the Congress certain amendments to the Clean Air Act. I support:

- Strong provisions to prevent the deterioration of air quality in already clean areas;
- A program to protect visibility in our national parks and wilderness areas;
- Strong enforcement tools, including economic penalties to eliminate the benefits of delay or noncompliance;
- The use of "best available control" technologies in all new facilities;
- Strict controls on coal-burning plants to insure that they meet air quality standards;
- Emission limitations for automobiles which help meet clean air goals but allow achievement of strict fuel economy standards;
- State implementation of inspection and maintenance programs in seriously polluted areas to ensure that automobiles continue to meet emission control requirements while in use.

In addition, I have instructed the Administrator of the Environmental Protection Agency to review his agency's regulations controlling new industrial growth in areas now violating air quality health standards and to recommend to me and to the Congress a fair and effective policy for meeting these standards in the future. Adoption of new legislative provisions in this area should await the results of this review.

WATER QUALITY

The nation has made considerable progress in cleaning up its waters under the program set forth in the 1972 amendments to the Federal Water Pollution Control Act, but much remains to be done in order to achieve the Act's goal of fishable and swimmable waters. Three areas deserve particular attention:

(1) To help control pollution from municipal sewage systems—an effort that currently involves 10,000 projects in planning or under construction—we need substantial additional funding. I have already asked the Congress to authorize the expenditure of $4.5 billion in each of the next ten years for municipal waste water treatment facilities and to allow a one-year extension in the September 1977 deadline for the obligation of construction grant funds. But at the same time we need to be sure that sewage projects supported by federal money do not create additional environmental problems, and that they are designated to encourage water conservation as well as water treatment. We also must ensure that the systems are operated properly once they have been built; that there is an effective pretreatment program to remove harmful industrial wastes from these systems; and that we are carefully considering alternative solutions, particularly in smaller communities, so that we can be sure of building the projects which are economically and environmentally most effective.

(2) I have already asked the Congress to increase the funds available for the Section 208 Planning Program, which helps place water quality management in the hands of state and local government, where much of the job of prevention and abatement must actually be done. This Section of the 1972 Amendments provides a means for addressing the increasingly serious problem of pollution caused by runoff from agriculture, mining, forestry, and urban streets. To make it operate effectively, tough state and local plans addressing these problems must be completed and implemented as soon as possible.

(3) Finally, I will be submitting further water quality amendments for your consideration in the current session. They will include provisions to make pollution unprofitable as well as illegal by imposing penalties on firms that have failed to abate their pollution on schedule; provisions to make law enforcement more stringent; and provisions necessary to ensure that actions are taken in accord with water quality management plans.

SOLID WASTE

"Solid wastes" are the discarded left-overs of our advanced consumer society. This growing mountain of garbage and trash represents not only an attitude of indifference toward valuable natural resources, but also a serious economic and public health problem.

The Resource Conservation and Recovery Act, passed in 1976, gave the Environmental Protection Agency the authority it needs to regulate hazardous wastes and to assure the safe disposal of other residues. Now it is important to move beyond the symptoms and address two principal causes of the solid waste problem: excessive packaging and inadequate use of recycled materials.

The Act requires the EPA to undertake, through an Interagency Resource Conservation Committee, a two-year study of ways to encourage waste reduction, recycling, and resource recovery with financial incentives like solid waste disposal charges, refundable deposits on containers, federal procurement of recycled materials, and excise taxes for litter clean-up. I am asking the Committee to accelerate its study and within six months present to me its first recommendations which are to address the use of solid waste disposal charges (levies on materials and products which reflect the costs associated with their ultimate disposal).

In addition, I am taking several actions to encourage resource conservation within the federal government. In the White House itself, recycled paper will be used wherever practicable as soon as present stocks of paper have been exhausted. I am instructing the Administrator of the General Services Administration and the heads of other appropriate federal agencies to institute a waste paper recycling program wherever practicable by the end of this calendar year. I am also instructing the GSA to revise its paper-product specifications to encourage the purchase of more recycled paper.

PEST MANAGEMENT

For several decades, chemical pesticides have been the foundation of agricultural, public health, and residential pest control. Approximately 1400 different chemicals are used in pesticide products, and some of these, as we have begun to discover, impose an unacceptable risk to our health and our environment.

To improve the safety and effectiveness of pest management, I am recommending two measures—one a short-term legislative step, and the other a long-term change in the way we approach this problem.

(1) I am asking the Administrator of the Environmental Protection Agency to work with the Congress in enacting an amendment to the Federal Insecticide, Fungicide, and Rodenticide Act which would allow the EPA to regulate directly these 1400 active chemical ingredients, rather than the 40,000 different commercial products which contain them in varying amounts. This change will help speed the registration of safe and desirable pest control compounds, and it will permit swifter revocation of registration for those which pose unwarranted risks.

(2) I am instructing the Council on Environmental Quality, at the conclusion of its ongoing review of integrated pest management in the United States, to recommend actions which the federal government can take to encourage the development and application of pest management techniques which emphasize the use of natural biological controls like predators, pest-specific diseases, pest-resistant plant varieties, and hormones, relying on chemical agents only as needed.

II. ENERGY AND THE ENVIRONMENT

In countless ways, our environment is affected by the production, distribution, and use of energy. Some of these—for example, the need to control oil tanker pollution and the need to restrict plutonium technology—I have already discussed in specific messages to the Congress. Others are implicit in my energy proposals, since the act of reversing our present wasteful energy practices will itself have many beneficial consequences for the environment. The transition to renewable energy sources, particularly solar energy, must be made. But it will take time. Meanwhile we should satisfy our energy needs from existing sources, both fossil and nuclear, in a safe and environmentally acceptable way. In particular, my Energy Plan outlined a number of steps this Administration will take to deal with domestic nuclear safety and spent fuel storage: an improved inspection program; mandatory reporting of all mishaps and failures; development of improved siting criteria; a review of the entire licensing process; and a review of the Energy Research and Development Administration's radioactive waste management program. The decisions we make about energy in the next few years will influence the environment of our country for generations.

THE OUTER CONTINENTAL SHELF

The oil and gas under federal ownership on the outer continental shelf must be developed in an orderly manner, reconciling the nation's energy needs with the fullest possible protection of the environment.

Amendments to the OCS Lands Act now being considered by the Congress, with provisions proposed by the Administration, will provide important new authority to the Secretary of the Interior. I urge expeditious passage of legislation to regulate the outer continental shelf, and in particular I favor provisions which would:

- Permit full evaluation of the effects of oil production, and cancel leases or terminate operations when harm or damage to the environment outweighs the advantage of continued operations;
- Improve consultation with states and communities to assure that they have a real role in decisions which affect them;
- Require industry to use the best available economically achievable safety and pollution control technology in operations in the outer continental shelf.

In addition to new legislation, certain administrative steps should be taken in this area. The first is to assess the size and scheduling of the OCS program. The Secretary of the Interior has already revised this program through 1978 to reflect reasonable production objectives as well as the various environmental considerations in each OCS region.

As the Secretary now proceeds to reevaluate the longer-term OCS program, I have directed him to work closely with the Governors of affected coastal states to guarantee that proposals for the timing and sequence of offshore lease sales are reasonable, not only in a technological sense but also in economic, social, and environmental respects. Because the Alaskan outer continental shelf is particularly sensitive and controversial, I am directing him to give special emphasis to it. I have also asked him to work closely with the Secretary of Commerce as she identifies potential marine sanctuaries in areas where leasing appears imminent.

To obtain fuller knowledge about the environmental impact of leasing and production, and to increase participation by the states in the process of decision, I have further directed the Secretary of the Interior to:

- Establish an OCS Information Clearinghouse to receive inquiries about federal OCS activity;
- Develop regulations, operating orders, and lease provisions specifying the information required from industry about both the offshore and onshore impacts of prospective development;
- Facilitate cooperative planning among industry, the Interior Department, the Department of Transportation, and the states for lease development, pipeline locations, pipeline standards, and onshore facilities;
- Establish procedures for compliance with the National Environmental Policy Act in connection with development plan approvals.

Because OCS activities should be administered in the most orderly way possible, I am directing the Secretary of the Interior to study carefully the prospect of reorganizing his Department's management of these valuable resources.

He and the Administrator of the Environmental Protection Agency should also coordinate their respective regulatory activities to ensure that exploration and development are not delayed by procedural confusion.

COAL

As our nation increasingly turns to coal as a replacement for our dwindling supplies of oil and gas, we must be sure that we will not fall short of the goals we have established to protect human health and the general environment.

Essential to environmentally sound use of coal is the expeditious passage of strong national strip mine legislation. My Administration has submitted to the Congress amendments by which alluvial valley floors, prime agricultural lands, and the mountains and valleys of Appalachia can be protected. These improvements, together with the comprehensive reclamation, administrative and enforcement provisions of the bill, will allow increased reliance on coal without sacrificing the environment. I urge final approval of this legislation in its strongest form. The Department of Interior has already begun preparation to implement the bill when it becomes law.

In the near term the switch to coal must be accomplished with currently available technology. In my Energy Plan I recognized that pollution control technology for direct combustion of coal is not fully adequate and directed that federal research be increased in certain key areas.

In the longer term, we must be sure that technological advances, such as conversion of coal to synthetic fuels, do not create undue environmental and health risks.

Accordingly, I am directing the Administrators of the Energy Research and Development Administration and the Environmental Protection Agency and the Secretary of Health, Education, and Welfare to establish a joint program to identify the health and environmental effects of each advanced technology that is the subject of federal research and development.

I am also directing the Administrators of the Energy Research and Development Administration and the Environmental Protection Agency jointly to develop procedures for establishing environmental protection standards for all new energy technologies. These procedures should be agreed upon within one year.

Because extensive use of coal requires huge amounts of water, I am directing the Secretary of the Interior to prepare a nationwide evaluation of the water supply needs and availability for development of various energy resources. He should prepare his report in cooperation with the Water Resources Council, the Administrator of the Energy Research and Development Administration, and other federal agencies.

The newly enacted Coal Leasing Amendments and the Federal Land Management and Policy Act provide the Secretary of the Interior with the necessary authority to carry out environmentally sound, comprehensive planning for the public lands. His duty now is to implement an affirmative program for managing coal lands and associated resources in a manner that fully protects the public interest and respects the rights of private surface owners.

To accomplish this, I am directing the Secretary of the Interior to manage the coal leasing program to assure that it can respond to reasonable production goals by leasing only those areas where mining is environmentally acceptable and compatible with other land uses. Specifically:

- The Secretary of the Interior, using environmental reviews, coal assessments, and indications of market interest, should determine which lands are appropriate to offer for lease.
- Land use plans should be completed before a decision to offer specific tracts for sale.
- No tract should be leased unless the Secretary is satisfied that the environmental impact of mining would be acceptable and that the federal government will receive a fair market value for the lease.

In response to concern about the large numbers of nonproducing federal coal leases in the Western states, I am directing the Secretary of the Interior to scrutinize the existing leases (and applications for preference right leases) to determine whether they show prospects for timely development in an environmentally acceptable manner. He should take whatever steps are necessary to deal with nonproducing and environmentally unsatisfactory leases and applications. These may include the following:

- Exchange of environmentally unsatisfactory leases or applications for environmentally acceptable coal lands of equivalent value;
- Reassessment of the basis for granting or denying preference right leases;
- Submission of legislation to authorize the condemnation of outstanding rights upon payment of reasonable compensation, if necessary to prevent environmental damage.

III. THE URBAN ENVIRONMENT

The National Environmental Policy Act speaks of the need to assure every American safe and healthful surroundings in which to live and work. For many of our citizens in urban areas, this goal is still remote.

Many existing environmental protection programs directly benefit the cities, of course, because that is where most of our pollution problems are. For example, controls on the emission of lead from automobile exhaust are of serious concern to inner-city residents. And as water pollution programs make rivers and streams cleaner, there will be more recreational opportunities in urban areas.

City life need not be a discouraging struggle against adversity; it can be an enriching experience. But it will take more than stopping pollution to make our cities the congenial, liveable places they ought to be.

To halt the degradation of the urban environment and to conserve and develop its rich historic and physical resources, the place to begin is with the neighborhoods themselves. In the past, wholesale destruction and rebuilding have led to a spurious "renewal" that destroys the sense of human community on which a city's vigor depends. By redirecting the resources of the federal government into neighborhood preservation and conservation, we can begin the work of intelligently restoring our cities. These proposals are part of that program:

- I am directing all federal agencies to assess their programs to ensure that they take advantage of our rich architectural heritage wherever possible, for example by locating federal offices in historic buildings and by supporting projects that are compatible with and contribute to the local cultural and historic environment.
- I have instructed the Secretary of Housing and Urban Development to expand the urban homesteading program by making available more and better-quality houses; by ensuring that adequate rehabilitation assistance is available to participants; and by coordinating the program more closely with other federal, state, and community efforts.

IV. NATURAL RESOURCES

Protection of this country's natural resources depends in large part on the actions, leadership, and example of the Federal government. Too often our water, wetlands, minerals, timber, and other resources have been managed imprudently, in disregard of sound environmental principles. Too often, narrow economic interests have enjoyed undue influence over the use of our public domain. As a result the resources which belong to all our citizens have sometimes been carelessly squandered.

My Administration is committed to a policy of effective stewardship of our public lands and natural resources. That policy includes conservation, multiple use of resources, and a reluctance to disrupt natural ecosystems. At a time when it has become apparent that we can no longer afford the waste and misuse of any natural resources, the need for these steps is clear.

WATER RESOURCES POLICY

One of the pressing domestic issues facing this Administration and this Congress is the establishment of a national water resources management policy.

I believe that it is essential to confine the public works efforts of the water development agencies to projects that can meet such defensible criteria as economic efficiency, safety, environmental protection, and fair distribution of project benefits. I have already recommended to the Congress a number of cost-saving adjustments in our water resource programs. Beyond that, we need comprehensive reform of water resources policy, with water conservation as its cornerstone.

I am therefore directing the Office of Management and Budget, the Council on Environmental Quality, and the Water Resources Council to conduct, in consultation with the Congress and with the public, a review of the present federal water resource policy. I have requested them to complete this joint study within six months and to present me with concrete recommendations for policy coordination and reform.

In addition, as a first step in redirecting present practices, I am today issuing an Executive Order designed to minimize the potential loss of human life and property from floods. This Order directs all appropriate federal agencies to refrain from supporting, funding, or issuing permits and licenses to new construction projects located in floodplains unless the agency determines that no practicable alternative location exists.

WETLANDS

The important ecological function of coastal and inland wetlands is well known to natural scientists. The lasting benefits that society derives from these areas often far exceed the immediate advantage their owners might get from draining or filling them. Their destruction shifts economic and environmental costs to other citizens—often in other states—who have had no voice in the decision to alter them.

We are losing wetlands at the rate of some 300,000 acres per year. While many of the individual developments which have caused this loss may once have been appropriate—and some still may be—we must now protect against the cumulative effects of reducing our total wetlands acreage. For these reasons, I am proposing a concerted federal effort to protect our wetlands. This includes the following steps:

(1) The federal government will no longer subsidize the destruction of wetlands. I am today issuing an Executive Order directing all appropriate federal agencies to refrain from giving financial support to proposed developments in wetlands unless the agency determines that no practicable alternative sites exist.

(2) I support implementation of the Federal Water Pollution Control Act program which regulates the filling and disposal of dredged materials in all U.S. waters or associated wetlands. This important program is essential to wetlands protection, but it should be carried out in a way that avoids undue federal regulation. The present program exempts normal farming, ranching, and forestry practices, and it allows for general permits that do not tie up individuals in unnecessary red tape. These provisions have my support. My forthcoming amendments to the Federal Water Pollution Control Act will include proposals to improve wetlands protection and to authorize the states to assume responsibility for carrying out major portions of this program.

(3) To protect and sustain waterfowl for recreational enjoyment, I am proposing a budget increase of $50 million over the next five years to purchase wetlands, and I have already included in both the FY 1977 and FY 1978 budgets another $10 million for this purpose. I also urge the Congress to enact legislation increasing the price of migratory bird conservation and hunting stamps (the so-called "duck" stamp) so that additional revenue will be available for waterfowl habitat acquisition.

COASTAL BARRIER ISLANDS

Coastal barrier islands are a fragile buffer between the wetlands and the sea. The 189 barrier islands on the Atlantic and Gulf Coasts are an integral part of an ecosystem which helps protect inland areas from flood waves and hurricanes. Many of them are unstable and not suited for development, yet in the past the federal government has subsidized and insured new construction on them. Eventually, we can expect heavy economic losses from this shortsighted policy.

About 68 coastal barrier islands are still unspoiled. Because I believe these remaining natural islands should be protected from unwise development, I am directing the Secretary of the Interior, in consultation with the Secretary of Commerce, the Council on Environmental Quality, and state and local officials of coastal areas, to develop an effective plan for protecting the islands.

His report should include recommendations for action to achieve this purpose.

MARINE SANCTUARIES

Existing legislation allows the Secretary of Commerce to protect certain estuarine and ocean resources from the ill-effects of development by designating marine sanctuaries. Yet only two sanctuaries have been established since 1972, when the program began.

I am, therefore, instructing the Secretary of Commerce to identify possible sanctuaries in areas where development appears imminent, and to begin collecting the data necessary to designate them as such under the law.

MINING

For more than a century, the development of hardrock minerals on the public lands has been governed by the Mining Law of 1872. This law once served an important purpose: encouraging settlement of the West and rapid development of mineral wealth there. But it is now outdated and inadequate. It fails to set forth clear authority for establishing environmental standards, and in some cases has allowed mining operations to degrade the water, soil, and air. It ignores the need for balanced management of resources and it has permitted the public's mineral resources to be developed without any royalty return to the federal treasury.

Therefore I am today instructing the Secretary of the Interior to prepare, for submission to the Congress, legislation to replace the Mining Law of 1872 with one more suited to contemporary needs. Among its provisions should be these: (1) a leasing system for publicly owned hardrock minerals; (2) explicit federal discretionary authority over mineral exploration and development on the public lands; (3) strict standards for environmental protection and for reclamation of mined areas; (4) a requirement for approval of operation and reclamation plans before mining can begin; (5) royalties for use of public lands and mineral resources, and (6) the integration of mining into land use plans being developed for the public lands.

FOREST MANAGEMENT

Since the passage in recent years of landmark legislation—the Forest and Rangelands Renewable Resources Planning Act, and the National Forest Management Act—the greatest challenge remaining to American forestry is to improve the condition and production of small private forest holdings. Various federal programs have, in the past, encouraged better management of these 296 million acres, which account for three-fifths of America's total productive forests. Now it is time to consider whether they are accomplishing their purpose.

Consequently, I am asking the Secretary of Agriculture to undertake a comprehensive study of the Cooperative Forestry Program. This study should consider the need for measures to:

- Assure that forestry programs support national environmental goals;
- Assure that assistance to non-federal forest owners will emphasize interdisciplinary planning and multiple use management;
- Improve the capability of private forest lands to meet the nation's need for wood;

- Prevent and control pollution, fires, and insects and diseases that damage forests, using environmentally sound methods, such as biological pest controls;
- Improve and maintain fish and wildlife habitats, particularly those that are critical for threatened and endangered species;
- Strengthen planning and management capabilities of state and local forestry agencies.

The study should also examine the desirability of providing financial assistance to state forestry agencies on the basis of state forestry plans rather than through the present fragmented approach.

OFF-ROAD VEHICLES

While off-road vehicles provide enjoyment and recreation for many, their indiscriminate use poses a threat to our public lands. Uncontrolled, they have ruined fragile soils, harassed wildlife, and damaged unique archaeological sites.

In 1972, federal agencies began to control the use of such vehicles on the public lands under Executive Order 11644. While these regulations have achieved some measure of protection for the soil, vegetation, and other values of the public lands, environmental damage has continued in certain areas. Accordingly, I am today amending this Executive Order to exclude off-road vehicles from certain portions of the public lands where their use has caused (or seems likely to cause) considerable environmental damage.

V. THE NATIONAL HERITAGE

In its land and its history, a nation finds the things which give it continuity. By preserving places that have special natural, historical, cultural, and scientific value, we can ensure that our children and grandchildren have a chance to know something of the America that we—and our ancestors—simply took for granted.

More than 300 such places have already been set aside in our National Park System. I have already demonstrated my support for the National Park Service by submitting to the Congress an accelerated, five-year, $759 million program to develop new and existing parklands, and to increase the park staff so that these irreplaceable resources can be better protected and seen by more visitors.

This step, though clearly needed, must be supported by a thorough reexamination of existing federal programs dealing with our natural and historic heritage. These have proliferated in a way that serves neither efficiency nor effectiveness, and they have sometimes impeded the preservationist efforts of states and private citizens. I believe we should establish a comprehensive federal program, to be known as the National Heritage Trust, to identify, acquire, and protect these resources; to provide for rapid acquisition of the most significant and endangered areas and examples of natural ecosystems; to protect areas already within federal jurisdiction; and to coordinate federal programs with states and private citizens more effectively. I have directed the Secretary of the Interior to develop a National Heritage Trust proposal within 120 days.

ALASKA

While my National Heritage Trust proposal will focus on small but important areas, the Congress now has an opportunity of historic dimensions to conserve large unspoiled sections of the American wilderness in Alaska. Under the terms of the Alaska Native Claims Act, the Congress is to consider designation of major additions to the National Park, Forest, Wildlife Refuge, and Wild and Scenic River Systems. We can double the size of the

Wildlife Refuge and the Park Systems, as well as add to the Forest and Wild and Scenic River Systems, at no acquisition cost. No conservation action the 95th Congress could take would have more lasting value than this. But if Congress fails to act by December 1978, the opportunity will be automatically lost. In the near future, my Administration will submit detailed recommendations for these Alaskan lands.

WILDERNESS

When the Congress passed the Wilderness Act in 1964, it established a landmark of American conservation policy. The National Wilderness Preservation System created by this Act must be expanded promptly, before the most deserving areas of federal lands are opened to other uses and lost to wilderness forever. I endorse, and in some cases am proposing to expand, all of the more than 24 million acres of wilderness proposals submitted to the Congress by previous Administrations.

Among the proposed areas I will recommend to enlarge are the following:

—Idaho and Salmon River Breaks Wilderness, Idaho;
—Guadalupe Escarpment Wilderness, New Mexico and Texas;
—Beartooth—Absaroka Wilderness, Montana and Wyoming;
—Grand Canyon National Park, Arizona;
—Kenai Moose Range, Alaska.

I am submitting new wilderness proposals for:

—Arches National Park, Utah;
—Canyon Lands National Park, Utah;
—Capitol Reef National Park, Utah;
—Buffalo National River, Arkansas.

I will soon submit a proposal to designate as wilderness portions of Gulf Island National Seashore in Mississippi and Florida, and I will give early attention to other wilderness proposals, including portions of the Oregon Dunes National Recreation Area, Oregon, and Aravaipa Canyon, Arizona, which would be the first wilderness area on Bureau of Land Management lands. In addition, I support the objectives of the Endangered Wilderness legislation now pending before Congress. Members of my Administration have recently testified in favor of immediate wilderness designation or protective study designation for all areas in this bill.

I recognize the special need to preserve wilderness east of the Rockies and in Alaska, and I am directing that federal agencies expedite the preparation of wilderness proposals for these areas.

Finally, I have directed the Secretary of the Interior to initiate a vigorous wilderness program for the Bureau of Land Management under the new Federal Land Management and Policy Act of 1976.

WILD AND SCENIC RIVERS

To date only 19 free-flowing rivers, totalling 1,655 miles, have been designated as part of the National Wild and Scenic Rivers System. Another 31 rivers have been identified as worthy of study for designation in the future.

We must identify as quickly as possible the best remaining candidates for inclusion in the Wild and Scenic Rivers System before they are dammed, channelized, or damaged by unwise development along their banks. As a first step, therefore, I am proposing legislation to add segments of eight rivers, totalling 1,303 miles, to the system:

—Bruneau River, Idaho;
—Pere Marquette River, Michigan;
—Dolores River, Colorado;
—Rio Grande River, Texas;
—Salmon River, Idaho;

—Skagit River, Washington;
—Upper Delaware River, Pennsylvania and New York;
—Upper Mississippi River, Minnesota.

I further propose to designate twenty river segments for study as potential additions to the National Wild and Scenic Rivers System:

—Gila River, New Mexico;
—Green River, Utah;
—Illinois River, Arkansas;
—North Fork of the Kern River, California;
—Shenandoah River, Virginia and West Virginia;
—Sweetwater River, Wyoming;
—Cacapon River, West Virginia;
—Columbia River, Washington;
—Guadalupe River, Texas;
—John Day River, Oregon;
—Loxahatchee River, Florida;
—Niobrara River, Nebraska;
—Tangipahoa River, Louisiana and Mississippi;
—Yellowstone River, Wyoming and Montana;
—Ogeechee River, Georgia;
—Salt River, Arizona;
—Wenatchee River, Washington;
—Gulkana River, Alaska;
—Delta River, Alaska;
—Madison River, Montana.

I am also transmitting to the Congress reports on the Gasconade River in Missouri and the Penobscot River in Maine. After thorough study, both of these rivers have been found to qualify for inclusion in the National System with the recommendation that they be administered by the states. I am pleased at the number of states taking positive action to protect their natural resources and assure them that any proposals to add State-administered rivers to the National System will be sympathetically considered by the Secretary of the Interior.

I am also submitting legislation to the Congress to withdraw authority for future construction of the Cross-Florida Barge Canal, to extend the boundaries of the Ocala National Forest to protect the Oklawaha River, and to authorize study of the Oklawaha River for possible designation as a Wild and Scenic River. Enactment of this legislation will put an end to the long controversy over this ill-advised project. I am also directing the Secretary of Agricuture, the Secretary of the Army, and other appropriate federal agencies, in cooperation with the State of Florida, to recommend ways to dispose of canal lands and structures, as well as ways to restore the Oklawaha River portion of the project area.

NATIONAL TRAILS

In 1968 Congress passed the National Trails System Act, the purpose of which was to designate and preserve a national system of recreational and scenic trails. Nine years later only two have been designated: the Appalachian Trail and the Pacific Coast Trail. Other unprotected trails on public lands have in the meantime become unusable. In some areas almost half the once-available trail mileage has been lost.

To restore and broaden the National Trails System, I am submitting legislation to designate three new Scenic Trails:

—a Continental Divide Scenic Trail of 3100 miles along the Rocky Mountains crest from Canada to Mexico;
—a North Country Scenic Trail of 3200 miles from eastern New York to North Dakota; and

—a Potomac Heritage Scenic Trail of 847 miles along the Potomac River from Chesapeake Bay to West Virginia and Pennsylvania.

In the near future I will also submit legislation to amend the National Trails System Act by adding a new category—Historic Trails—and I will give early attention to submitting trails in this new category.

WILDLIFE

When explorers and settlers from Europe first came to America, they were astonished at the richness and variety of wildlife in our lands and waters. Faced with such abundance, for years most Americans have valued only game species of wildlife. Our allocation of federal funds for wildlife research and management still reflects this outdated view. Ninety-seven out of every hundred federal wildlife dollars are devoted to the less than one percent of vertebrate species that are hunted or fished for commerce or sport. To the rest, little attention has been given, even though they are part of the biological system that sustains us. To correct this imbalance, I am directing the Secretary of the Interior (1) to encourage states to apply existing federal-aid funds to the management of all species of wildlife, and (2) to propose other measures to improve the conservation of nongame wildilfe.

Our Nation's public lands and waters support a rich wildlife resource which we hold in trust for all Americans, now and in the future. My administration will assure that this public trust—for all wildlife—is adequately and effectively executed.

The public's interest in wildlife specifically includes predators, which have in the past sometimes been regarded as competitors for livestock or game, leading to their destruction (and in the case of some large predator species, to their extermination). Because we now realize the importance of the role that predators play in various ecosystems, our goal should be not to destroy them but to reduce the occasion for their conflict with livestock. My Administration will continue to support the existing Executive Order which prohibits the routine use of poisons for killing predators on the public lands. If control is necessary, it should focus on the individual predators causing the problem—not the species as a whole.

Many land and water development projects cause extensive damage to fish and wildlife habitat. My Administration will ensure timely implementation of the mitigation features required by the Fish and Wildlife Coordination Act to make up for such losses. Furthermore, to hasten the protection of threatened and endangered species, I am directing the Secretaries of Commerce and Interior to coordinate a government-wide effort, as required by the Endangered Species Act of 1973, to identify all habitat under Federal jurisdiction or control that is critical to the survival and recovery of these species. The purpose of this program is to avoid the possibility that such habitats will be identified too late to affect federal project planning. Major projects now underway that are found to pose a serious threat to endangered species should be reassessed on a case-by-case basis.

In the past 150 years, hundreds of foreign wildlife species, both plant and animal, have been introduced into the natural ecosystems of the United States. Many of these have been highly detrimental to public health, agriculture, and native wildlife.

Consequently, I am today issuing an Executive Order restricting the introduction of exotic animals and plants into the United States and prohibiting their establishment on lands and waters managed by the federal government. In addition, I am directing the Secretaries of Agriculture and the Interior to develop further legislation to deal with the importation of exotic species.

The many laws which have recently been enacted to conserve our Nation's wildlife pose the risk of creating a confusing system of overlapping and conflicting requirements. Therefore, I am directing the Council on Environmental

Quality to consult with the states and executive agencies and report to me in six months on the steps that should be taken to simplify, coordinate, and codify the body of law affecting wildlife conservation.

Finally, I have asked the Congress to increase the 1978 Fish and Wildlife Service Budget by $23 million for environmental research, migratory bird protection, and aid to the states for endangered species. Because the maintenance and staffing of our national system of wildlife refuges has been sadly neglected for the past decade, I have also proposed a budget increase of $295 million for rehabilitation, habitat improvement, and development of this system during the next five years.

REDWOOD NATIONAL PARK

Congress created Redwood National Park in 1968 to protect a magnificent stand of the world's tallest trees. Subsequently, however, logging and road-building on adjacent private land have created severe erosion problems in the Redwood Creek Watershed. My Administration has proposed to the Congress that 48,000 carefully chosen acres be added to the Park, allowing us to protect existing parklands and to add to the Park additional stands of redwoods. This proposal would also provide for rehabilitation of the Redwood Creek Watershed.

Recognizing that further expansion of the Park might adversely affect the economies of nearby communities, I have directed the Secretaries of Commerce and Labor to develop a joint program to cushion the effects of temporary unemployment in the Redwood National Park area.

VI. THE GLOBAL ENVIRONMENT

Environmental problems do not stop at national boundaries. In the past decade we and other nations have come to recognize the urgency of international efforts to protect our common environment.

As part of this process, I am directing the Council on Environmental Quality and the Department of State, working in cooperation with the Environmental Protection Agency, the National Science Foundation, the National Oceanic and Atmospheric Administration, and other appropriate agencies, to make a one-year study of the probable changes in the world's population, natural resources, and environment through the end of the century. This study will serve as the foundation of our longer-term planning. I am also asking the Council on Environmental Quality, with the cooperation of the Department of State, to ensure that we achieve the best possible coordination of the international environmental programs within the Executive Branch.

WORLD POPULATION

Rapid population growth is a major environmental problem of world dimensions. World population increased from three to four billion in the last 15 years, substantially cancelling our expansion in world food production and economic growth of the same period.

Without controlling the growth of population, the prospects for enough food, shelter, and other basic needs for all the world's people are dim. Where existence is already poor and precarious, efforts to obtain the necessities of life often degrade the environment for generations to come.

It is, of course, up to each nation to determine its own policies, but we are prepared to respond promptly and fully to all requests for assistance in population and health care programs. At my direction, the Department of State and the Agency for International Development stand ready to cooperate through international organizations, through private voluntary organizations, or through direct contacts with other governments.

ENVIRONMENTAL CONSIDERATIONS IN ECONOMIC DEVELOPMENT ASSISTANCE

Whether to try to prevent or undo environmental damage is a decision each country must make for itself. But I am convinced that in the long run, development programs that are environmentally sound will yield the most economic benefits. To encourage the adoption of such programs, I have taken these steps:

(1) I have instructed the Secretary of State, the Administrator of AID, and other concerned federal agencies to ensure full consideration of the environmental soundness of development projects under review for possible assistance.

(2) I have asked the Administrator of AID to make available to developing countries assistance in environment and natural resources management. Such assistance could help developing countries design environmentally sound projects, regardless of the source of funding for a particular project.

INTERNATIONAL ENVIRONMENTAL AGREEMENTS

A number of federal agencies, under the guidance of the Council on Environmental Quality, are engaged in international conservation activity. I am directing my Administration to expand this effort, giving particular attention to the following areas:

(1) *The Endangered Species Convention* is now in effect. The next step is to implement the treaty effectively. The United States has begun efforts to prohibit trade in endangered species of plants and animals, and will encourage similar steps by other nations.

(2) Pursuant to the *Antarctic Treaty*, I am today submitting legislation to Congress to provide for special protection of the flora and fauna of Antarctica. Because this remote, unpopulated region greatly influences the stability of the entire earth's oceans and atmosphere, its unique environment must be preserved.

(3) *The Convention for Nature Protection and Wildlife Preservation in the Western Hemisphere* was signed by Franklin D. Roosevelt in 1940, but has yet to be carried out fully and systematically. I propose to the countries of the Americas that we now implement this Convention through the offices of the Organization of American States. I urge the development of a Pan-American Migratory Species Treaty, and the convening of an Inter-American Conference on the Management of Western Hemisphere Renewable Natural Resources. The United States has already offered to host the Conference.

(4) I soon will send to the Senate for ratification the *Treaty for the Conservation of Migratory Birds and Their Environment*, which we signed with the Soviet Union last November. This treaty—and the legislation I will submit to implement it—will establish new authority to conserve the habitat necessary to the survival of these birds.

SAVING THE WHALES

Sharing the worldwide public concern about the condition of marine mammals, especially whales, I have directed the Secretary of Commerce, with the foreign policy guidance of the Secretary of State to:

- Prohibit commercial whaling within our 200-mile fishery zone;
- Pursue negotiations within the International Whaling Commission for a stronger international conservation regime for whales and other cetaceans, affording protection for them throughout their range;
- Maintain firm U.S. support for a ten-year worldwide moratorium on the commercial killing of whales; and
- Report to me within 60 days any actions by other countries that have diminished the effectiveness of the International Whaling Commission's conservation program.

VII. IMPROVING GOVERNMENT

The foregoing proposals, along with others which will follow in the coming years, constitute the most far-reaching environmental program ever put forward by an administration. My support for them is resolute, and it is personal. But belief in these goals does not necessarily means uncritical belief in the federal government's present methods for achieving them. In the past, our environmental policies have not always used the most practical tools, nor the least costly; they have sometimes imposed burdensome bureaucratic regulations where economic incentives could have done the job as well; and they have occasionally ignored the need for different solutions in different areas of our diverse country. There is room for improvement.

1. *Implementation of the National Environmental Policy Act*

This Act is best known for requiring federal agencies to prepare environmental impact statements before taking actions having significant environmental effects. In the seven years since its passage, it has had a dramatic—and beneficial—influence on the way new projects are planned. But to be more useful to decision-makers and the public, environmental impact statements must be concise, readable, and based upon competent professional analysis. They must reflect a concern with quality, not quantity. We do not want impact statements that are measured by the inch or weighed by the pound.

Accordingly, I am today issuing an Executive Order directing the Council on Environmental Quality to issue regulations requiring all federal agencies to meet these criteria and the provisions of Section 102(2) of the National Environmental Policy Act in the impact statements they prepare and to establish a procedure for referring to the Council differences among agencies concerning implementation of the National Environmental Policy Act.

2. *Coordination within the Federal Government*

Various programs within the Environmental Protection Agency provide funds to state and local government for planning, training, monitoring, enforcement, and research in pollution control. They are presently authorized under different pieces of legislation, funded by different offices within the agency, and entail different procedures for allocation of their funds. In the near future I will submit legislation to the Congress designed to bring these programs together into one comprehensive environmental grant program.

The problem of uncoordinated policy is, unfortunately, not confined to any single federal agency. Today, before any federal agency can construct a new project, or grant funds to local or state governments, or issue a permit to a private party, it must comply with more than a score of different environmental review requirements. I have directed the Council on Environmental Quality to examine the present federal environmental review requirements and to recommend specific measures, including legislation, to clarify and integrate them in a way compatible with my broader proposals for governmental reorganization.

I am also directing the Council on Environmental Quality to establish an interagency task force to review present environmental monitoring and data programs, and to recommend improvements that would make these programs more effective.

3. *Relations with Local Governments, Industry and the Public*

My Administration will, in a variety of ways, move to simplify the delivery of federal programs and encourage a greater degree of local control. There are almost five hundred separate federal programs, most of which have separate planning requirements, providing tens of billions of dollars in assistance to state and local government. My Administration will support measures to bring these programs under a consistent, comprehensive policy, and to give state and local areas more influence over federal actions which affect them.

My Administration will also promote better cooperation between government and industry to solve some of our serious remaining pollution problems. I have directed the Administrator of the Environmental Protection Agency to meet with representatives of major industrial groups and develop a joint government-industry research program for unsolved pollution problems.

Finally, my Administration will support efforts to lower the barriers, financial and otherwise, against active public involvement in decisions that affect the quality of the environment. The surest way to sustain our environmental laws is to encourage citizens to hold the government accountable for enforcing and obeying them.

JIMMY CARTER

The White House,
May 23, 1977.

EXECUTIVE ORDER 11987, EXOTIC ORGANISMS

By virtue of the authority vested in me by the Constitution and statutes of the United States of America, and as President of the United States of America, in furtherance of the purposes and policies of the Lacey Act (18 U.S.C. 42) and the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 *et seq.*), it is hereby ordered as follows:

SECTION 1. As used in this Order:

(a) "United States" means all of the several States, the District of Columbia, the Commonwealth of Puerto Rico, American Samoa, the Virgin Islands, Guam, and the Trust Territory of the Pacific Islands.

(b) "Introduction" means the release, escape, or establishment of an exotic species into a natural ecosystem.

(c) "Exotic species" means all species of plants and animals not naturally occurring, either presently or historically, in any ecosystem of the United States.

(d) "Native species" means all species of plants and animals naturally occurring, either presently or historically, in any ecosystem of the United States.

SEC. 2. (a) Executive agencies shall, to the extent permitted by law, restrict the introduction of exotic species into the natural ecosystems on lands and waters which they own, lease, or hold for purposes of administration; and, shall encourage the States, local governments, and private citizens to prevent the introduction of exotic species into natural ecosystems of the United States.

(b) Executive agencies, to the extent they have been authorized by statute to restrict the importation of exotic species, shall restrict the introduction of exotic species into any natural ecosystem of the United States.

(c) Executive agencies shall, to the extent permitted by law, restrict the use of Federal funds, programs, or authorities used to export native species for the purpose of introducing such species into ecosystems outside the United States where they do not naturally occur.

(d) This Order does not apply to the introduction of any exotic species, or the export of any native species, if the Secretary of Agriculture or the Secretary of the Interior finds that such introduction or exportation will not have an adverse effect on natural ecosystems.

SEC. 3. The Secretary of the Interior, in consultation with the Secretary of Agriculture and the heads of other appropriate agencies, shall develop and implement, by rule or regulation, a system to standardize and simplify the requirements, procedures and other activities appropriate for implementing the provisions of this Order. The Secretary of the Interior shall ensure that such rules or regulations are in accord with the performance by other agencies of those functions vested by law, including this Order, in such agencies.

JIMMY CARTER

The White House,
May 24, 1977.

EXECUTIVE ORDER 11988, FLOODPLAIN MANAGEMENT

By virtue of the authority vested in me by the Constitution and statutes of the United States of America, and as President of the United States of America, in furtherance of the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 *et seq.*), the National Flood Insurance Act of 1968, as amended (42 U.S.C. 4011 *et seq.*), and the Flood Disaster Protection Act of 1973 (Public Law 93–234, 87 Stat. 975), in order to avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative, it is hereby ordered as follows:

SECTION 1. Each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

SEC. 2. In carrying out the activities described in Section 1 of this Order, each agency has a responsibility to evaluate the potential effects of any actions it may take in a floodplain; to ensure that its planning programs and budget requests reflect consideration of flood hazards and floodplain management; and to prescribe procedures to implement the policies and requirements of this Order, as follows:

(a)(1) Before taking an action, each agency shall determine whether the proposed action will occur in a floodplain—for major Federal actions significantly affecting the quality of the human environment, the evaluation required below will be included in any statement prepared under Section 102(2)(C) of the National Environmental Policy Act. This determination shall be made according to a Department of Housing and Urban Development (HUD) floodplain map or a more detailed map of an area, if available. If such maps are not available, the agency shall make a determination of the location of the floodplain based on the best available information. The Water Resources Council shall issue guidance on this information not later than October 1, 1977.

(2) If an agency has determined to, or proposes to, conduct, support, or allow an action to be located in a floodplain, the agency shall consider alternatives to avoid adverse effects and incompatible development in the floodplains. If the head of the agency finds that the only practicable alternative consistent with the law and with the policy set forth in this Order requires siting in a floodplain, the agency shall, prior to taking action, (i) design or modify its action in order to minimize potential harm to or within the floodplain, consistent with regulations issued in accord with Section 2(d) of this Order, and (ii) prepare and circulate a notice containing an explanation of why the action is proposed to be located in the floodplain.

(3) For programs subject to the Office of Management and Budget Circular A-95, the agency shall send the notice, not to exceed three pages in length including a location map, to the state and areawide A-95 clearinghouses for the geographic areas affected. The notice shall include: (i) the reasons why the action is proposed to be located in a floodplain; (ii) a statement indicating whether the action conforms to applicable state or local floodplain protection standards and (iii) a list of the alternatives considered. Agencies shall endeavor to allow a brief comment period prior to taking any action.

(4) Each agency shall also provide opportunity for early public review of any plans or proposals for actions in floodplains, in accordance with Section 2(b) of Executive Order No. 11514, as amended, including the development of procedures to accomplish this objective for Federal actions whose impact is not significant enough to require the preparation of an environmental impact statement under Section 102(2)(C) of the National Environmental Policy Act of 1969, as amended.

(b) Any requests for new authorizations or appropriations transmitted to the Office of Management and Budget shall indicate, if an action to be proposed will be located in a floodplain, whether the proposed action is in accord with this Order.

(c) Each agency shall take floodplain management into account when formulating or evaluating any water and land use plans and shall require land and water resources use appropriate to the degree of hazard involved. Agencies shall include adequate provision for the evaluation and consideration of flood hazards in the regulations and operating procedures for the licenses, permits, loan or grants-in-aid programs that they administer. Agencies shall also encourage and provide appropriate guidance to applicants to evaluate the effects of their proposals in floodplains prior to submitting applications for Federal licenses, permits, loans or grants.

(d) As allowed by law, each agency shall issue or amend existing regulations and procedures within one year to comply with this Order. These procedures shall incorporate the United National Program for Floodplain Management of the Water Resources Council, and shall explain the means that the agency will employ to pursue the nonhazardous use of riverine, coastal and other floodplains in connection with the activities under its authority. To the extent possible, existing processes, such as those of the Council on Environmental Quality and the Water Resources Council, shall be utilized to fulfill the requirements of this Order. Agencies shall prepare their procedures in consultation with the Water Resources Council, the Federal Insurance Administration, and the Council on Environmental Quality, and shall update such procedures as necessary.

Sec. 3. In addition to the requirements of Section 2, agencies with responsibilities for Federal real property and facilities shall take the following measures:

(a) The regulations and procedures established under Section 2(d) of this Order shall, at a minimum, require the construction of Federal structures and facilities to be in accordance with the standards and criteria and to be consistent with the intent of those promulgated under the National Flood Insurance Program. They shall deviate only to the extent that the standards of the Flood Insurance Program are demonstrably inappropriate for a given type of structure or facility.

(b) If, after compliance with the requirements of this Order, new construction of structures or facilities are to be located in a floodplain, accepted floodproofing and other flood protection measures shall be applied to new construction or rehabilitation. To achieve flood protection, agencies shall, wherever practicable, elevate structures above the base flood level rather than filling in land.

(c) If property used by the general public has suffered flood damage or is located in an identified flood hazard area, the responsible agency shall provide on structures, and other places where appropriate, conspicuous delineation of past and probable flood height in order to enhance public awareness of and knowledge about flood hazards.

(d) When property in floodplains is proposed for lease, easement, right-of-way, or disposal to non-Federal public or private parties, the Federal agency shall (1) reference in the conveyance those uses that are restricted under identified Federal, State, or local floodplain regulations; and (2) attach other appropriate restrictions to the uses of properties by the grantee or purchaser and any successors, except where prohibited by law; or (3) withhold such properties from conveyance.

SEC. 4. In addition to any responsibilities under this Order and Sections 202 and 205 of the Flood Disaster Protection Act of 1973, as amended (42 U.S.C. 4106 and 4128), agencies which guarantee, approve, regulate, or insure any financial transaction which is related to an area located in a floodplain shall, prior to completing action on such transaction, inform any private parties participating in the transaction of the hazards of locating structures in the floodplain.

SEC. 5. The head of each agency shall submit a report to the Council on Environmental Quality and to the Water Resources Council on June 30, 1978, regarding the status of their procedures and the impact of this Order on the agency's operations. Thereafter, the Water Resources Council shall periodically evaluate agency procedures and their effectiveness.

SEC. 6. As used in this Order:

(a) The term "agency" shall have the same meaning as the term "Executive agency" in Section 105 of Title 5 of the United States Code and shall include the military departments; the directives contained in this Order, however, are meant to apply only to those agencies which perform the activities described in Section 1 which are located in or affecting floodplains.

(b) The term "base flood" shall mean that flood which has a one percent or greater chance of occurrence in any given year.

(c) The term "floodplain" shall mean the lowland and relatively flat areas adjoining inland and coastal waters including floodprone areas of offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year.

SEC. 7. Executive Order No. 11296 of August 10, 1966, is hereby revoked. All actions, procedures, and issuances taken under that Order and still in effect shall remain in effect until modified by appropriate authority under the terms of this Order.

SEC. 8. Nothing in this Order shall apply to assistance provided for emergency work essential to save lives and protect property and public health and safety, performed pursuant to Sections 305 and 306 of the Disaster Relief Act of 1974 (88 Stat. 148, 42 U.S.C. 5145 and 5146).

SEC. 9. To the extent the provisions of Section 2(a) of this Order are applicable to projects covered by Section 104(h) of the Housing and Community Development Act of 1974, as amended (88 Stat. 640, 42 U.S.C. 5304 (h)), the responsibilities under those provisions may be assumed by the appropriate applicant, if the applicant has also assumed, with respect to such projects, all of the responsibilities for environmental review, decisionmaking, and action pursuant to the National Environmental Policy Act of 1969, as amended.

JIMMY CARTER

The White House,
May 24, 1977.

STATEMENT BY THE PRESIDENT ACCOMPANYING EXECUTIVE ORDER 11988

The floodplains which adjoin the Nation's inland and coastal waters have long been recognized as having special values to our citizens. They have provided us with wildlife habitat, agricultural and forest products, stable ecosystems, and park and recreation areas. However, unwise use and development of our riverine, coastal, and other floodplains not only destroy many of the special qualities of these areas but pose a severe threat to human life, health, and property.

Since the adoption of a national flood control policy in 1936, the Federal Government has invested about $10 billion in flood protection works. Despite substantial efforts by the Federal Government to reduce flood hazards and protect floodplains, annual losses from floods and adverse alteration of floodplains continue to increase.

The problem arises mainly from unwise land use practices. The Federal Government can be responsible for or can influence these practices in the construction of projects, in the management of its own properties, in the provision of financial or technical assistance including support of financial institutions, and in the uses for which its agencies issue licenses or permits. In addition to minimizing the danger to human and nonhuman communities living in floodplains, active floodplain management represents sound business practice by reducing the risk of flood damage to properties benefiting from Federal assistance.

Because unwise floodplain development can lead to the loss of human and other natural resources, it is simply a bad Federal investment and should be avoided. In order to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative, I have issued an Executive order on floodplain management.

EXECUTIVE ORDER 11989, OFF-ROAD VEHICLES ON PUBLIC LANDS

By virtue of the authority vested in me by the Constitution and statutes of the United States of America, and as President of the United States of America, in order to clarify agency authority to define zones of use by off-road vehicles on public lands, in furtherance of the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4231 *et seq.*), Executive Order No. 11644 of February 8, 1972, is hereby amended as follows:

SECTION 1. Clause (B) of Section 2(3) of Executive Order No. 11644, setting forth an exclusion from the definition of off-road vehicles, is amended to read "(B) any fire, military, emergency or law enforcement vehicle when used for emergency purposes, and any combat or combat support vehicle when used for national defense purposes, and".

SEC. 2. Add the following new Section to Executive Order No. 11644.

"SEC. 9. *Special Protection of the Public Lands.* (a) Notwithstanding the provisions of Section 3 of this Order, the respective agency head shall, whenever he determines that the use of off-road vehicles will cause or is causing considerable adverse effects on the soil, vegetation, wildlife, wildlife habitat or cultural or historic resources of particular areas or trails of the public lands, immediately close such areas or trails to the type of off-road vehicle causing such effects, until such time as he determines that such adverse effects have been eliminated and that measures have been implemented to prevent future recurrence.

"(b) Each respective agency head is authorized to adopt the policy that portions of the public lands within his jurisdiction shall be closed to use by off-road vehicles except those areas or trails which are suitable and specifically designated as open to such use pursuant to Section 3 of this Order.".

JIMMY CARTER

The White House,
May 24, 1977.

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EXECUTIVE ORDER 11990, PROTECTION OF WETLANDS

By virtue of the authority vested in me by the Constitution and statutes of the United States of America, and as President of the United States of America, in furtherance of the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 *et seq.*), in order to avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative, it is hereby ordered as follows:

Section 1. (a) Each agency shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; and (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

(b) This Order does not apply to the issuance by Federal agencies of permits, licenses, or allocations to private parties for activities involving wetlands on non-Federal property.

Sec. 2. (a) In furtherance of Section 101(b)(3) of the National Environmental Policy Act of 1969 (42 U.S.C. 4331(b)(3)) to improve and coordinate Federal plans, functions, programs and resources to the end that the Nation may attain the widest range of beneficial uses of the environment without degradation and risk to health or safety, each agency, to the extent permitted by law, shall avoid undertaking or providing assistance for new construction located in wetlands unless the head of the agency finds (1) that there is no practicable alternative to such construction, and (2) that the proposed action includes all practicable measures to minimize harm to wetlands which may result from such use. In making this finding the head of the agency may take into account economic, environmental and other pertinent factors.

(b) Each agency shall also provide opportunity for early public review of any plans or proposals for new construction in wetlands, in accordance with Section 2(b) of Executive Order No. 11514, as amended, including the development of procedures to accomplish this objective for Federal actions whose impact is not significant enough to require the preparation of an environmental impact statement under Section 102(2)(C) of the National Environmental Policy Act of 1969, as amended.

Sec. 3. Any requests for new authorizations or appropriations transmitted to the Office of Management and Budget shall indicate, if an action to be proposed will be located in wetlands, whether the proposed action is in accord with this Order.

Sec. 4. When Federally-owned wetlands or portions of wetlands are proposed for lease, easement, right-of-way or disposal to non-Federal public or private parties, the Federal agency shall (a) reference in the conveyance those uses that are restricted under identified Federal, State or local wetlands regulations; and (b) attach other appropriate restrictions to the uses of properties by the grantee or purchaser and any successor, except where prohibited by law; or (c) withhold such properties from disposal.

Sec. 5. In carrying out the activities described in Section 1 of this Order, each agency shall consider factors relevant to a proposal's effect on the survival and quality of the wetlands. Among these factors are:

(a) public health, safety, and welfare, including water supply, quality, recharge and discharge; pollution; flood and storm hazards; and sediment and erosion;

(b) maintenance of natural systems, including conservation and long term productivity of existing flora and fauna, species and habitat diversity and stability, hydrologic utility, fish, wildlife, timber, and food and fiber resources; and

(c) other uses of wetlands in the public interest, including recreational, scientific, and cultural uses.

Sec. 6. As allowed by law, agencies shall issue or amend their existing procedures in order to comply with this Order. To the extent possible, existing processes, such as those of the Council on Environmental Quality and the Water Resources Council, shall be utilized to fulfill the requirements of this Order.

Sec. 7. As used in this Order:

(a) The term "agency" shall have the same meaning as the term "Executive agency" in Section 105 of Title 5 of the United States Code and shall include the military departments; the directives contained in this Order, however, are meant to apply only to those agencies which perform the activities described in Section 1 which are located in or affecting wetlands.

(b) The term "new construction" shall include draining, dredging, channelizing, filling, diking, impounding, and related activities and any structures or facilities begun or authorized after the effective date of this Order.

(c) The term "wetlands" means those areas that are inundated by surface or ground water with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mud flats, and natural ponds.

Sec. 8 This Order does not apply to projects presently under construction, or to projects for which all of the funds have been appropriated through Fiscal Year 1977, or to projects and programs for which a draft or final environmental impact statement will be filed prior to October 1, 1977. The provisions of Section 2 of this Order shall be implemented by each agency not later than October 1, 1977.

Sec. 9. Nothing in this Order shall apply to assistance provided for emergency work, essential to save lives and protect property and public health and safety, performed pursuant to Section 305 and 306 of the Disaster Relief Act of 1974 (88 Stat. 148, 42 U.S.C. 5145 and 5146).

Sec. 10. To the extent the provisions of Sections 2 and 5 of this Order are applicable to projects covered by Section 104(h) of the Housing and Community Development Act of 1974, as amended (88 Stat. 640, 42 U.S.C. 5304(h)), the responsibilities under those provisions may be assumed by the appropriate applicant, if the applicant has also assumed, with respect to such projects, all of the responsibilities for environmental review, decisionmaking, and action pursuant to the National Environmental Policy Act of 1969 as amended.

Jimmy Carter

The White House,
May 24, 1977.

STATEMENT BY THE PRESIDENT ACCOMPANYING EXECUTIVE ORDER 11990

The Nation's coastal and inland wetlands are vital natural resources of critical importance to the people of this country. Wetlands are areas of great natural productivity, hydrological utility, and environmental diversity, providing natural flood control, improved water quality, recharge of aquifers, flow stabilization of streams and rivers, and habitat for fish and wildlife resources. Wetlands contribute to the production of agricultural products and timber, and provide recreational, scientific, and aesthetic resources of national interest.

The unwise use and development of wetlands will destroy many of their special qualities and important natural functions. Recent estimates indicate that the United States has already lost over 40 percent of our 120 million acres of wetlands inventoried in the 1950's. This piecemeal alteration and destruction of wetlands through draining, dredging, filling, and other means has had an adverse cumulative impact on our natural resources and on the quality of human life.

The problem of loss of wetlands arises mainly from unwise land use practices. The Federal Government can be responsible for or can influence these practices in the construction of projects, in the management of its own properties, and in the provisions of financial or technical assistance.

In order to avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative, I have issued an Executive order on the protection of wetlands.

EXECUTIVE ORDER 11514, AS AMENDED BY EXECUTIVE ORDER 11991 (SECS. 2(g) AND 3(h)), MAY 24, 1977, PROTECTION AND ENHANCEMENT OF ENVIRONMENTAL QUALITY

By virtue of the authority vested in me as President of the United States and in furtherance of the purpose and policy of the National Environmental Policy Act of 1969 (Public Law No. 91–190, approved January 1, 1970), it is ordered as follows:

Section 1. *Policy*. The Federal Government shall provide leadership in protecting and enhancing the quality of the Nation's environment to sustain and enrich human life. Federal agencies shall initiate measures needed to direct their policies, plans and programs so as to meet national environmental goals. The Council on Environmental Quality, through the Chairman, shall advise and assist the President in leading this national effort.

Sec. 2. *Responsibilities of Federal agencies*. Consonant with Title I of the National Environmental Policy Act of 1969, hereafter referred to as the "Act", the heads of Federal agencies shall:

(a) Monitor, evaluate, and control on a continuing basis their agencies' activities so as to protect and enhance the quality of the environment. Such activities shall include those directed to controlling pollution and enhancing the environment and those designed to accomplish other program objectives which may affect the quality of the environment. Agencies shall develop programs and measures to protect and enhance environmental quality and shall assess progress in meeting the specific objectives of such activities. Heads of agencies shall consult with appropriate Federal, State and local agencies in carrying out their activities as they affect the quality of the environment.

(b) Develop procedures to ensure the fullest practicable provision of timely public information and understanding of Federal plans and programs with environmental impact in order to obtain the views of interested parties. These procedures shall include, whenever appropriate, provision for public hearings, and shall provide the public with relevant information, including information on alternative courses of action. Federal agencies shall also encourage State and local agencies to adopt similar procedures for informing the public concerning their activities affecting the quality of the environment.

(c) Insure that information regarding existing or potential environmental problems and control methods developed as part of research, development, demonstration, test, or evaluation activities is made available to Federal agencies, States, counties, municipalities, institutions, and other entities, as appropriate.

(d) Review their agencies' statutory authority, administrative regulations, policies, and procedures, including those relating to loans, grants, contracts, leases, licenses, or permits, in order to identify any deficiencies or inconsistencies therein which prohibit or limit full compliance with the purposes and provisions of the Act. A report on this review and the corrective actions taken or planned, including such measures to be proposed to the President as may be necessary to bring their authority and policies into conformance with the intent, purposes, and procedures of the Act shall be provided to the Council on Environmental Quality not later than September 1, 1970.

(e) Engage in exchange of data and research results, and cooperate with agencies of other governments to foster the purposes of the Act.

(f) Proceed, in coordination with other agencies, with actions required by section 102 of the Act.

(g) In carrying out their responsibilities under the Act and this Order, comply with the regulations issued by the Council except where such compliance would be inconsistent with statutory requirements.

SEC. 3. *Responsibilities of Council on Environmental Quality.* The Council on Environmental Quality shall:

(a) Evaluate existing and proposed policies and activities of the Federal Government directed to the control of pollution and the enhancement of the environment and to the accomplishment of other objectives which affect the quality of the environment. This shall include continuing review of procedures employed in the development and enforcement of Federal standards affecting environmental quality. Based upon such evaluations the Council shall, where appropriate, recommend to the President policies and programs to achieve more effective protection and enhancement of environmental quality and shall, where appropriate, seek resolution of significant environmental issues.

(b) Recommend to the President and to the agencies priorities among programs designed for the control of pollution and for enhancement of the environment.

(c) Determine the need for new policies and programs for dealing with environmental problems not being adequately addressed.

(d) Conduct, as it determines to be appropriate, public hearings or conferences on issues of environmental significance.

(e) Promote the development and use of indices and monitoring systems (1) to assess environmental conditions and trends, (2) to predict the environmental impact of proposed public and private actions, and (3) to determine the effectiveness of programs for protecting and enhancing environmental quality.

(f) Coordinate Federal programs related to environmental quality.

(g) Advise and assist the President and the agencies in achieving international cooperation for dealing with environmental problems, under the foreign policy guidance of the Secretary of State.

(h) Issue regulations to Federal agencies for the implementation of the procedural provisions of the Act (42 U.S.C. 4332(2)). Such regulations shall be developed after consultation with affected agencies and after such public hearings as may be appropriate. They will be designed to make the environmental impact statement process more useful to decisionmakers and the public; and to reduce paperwork and the accumulation of extraneous background data, in order to emphasize the need to focus on real environmental issues and alternatives. They will require impact statements to be concise, clear, and to the point, and supported by evidence that agencies have made the necessary environmental analyses. The Council shall include in its regulations procedures (1) for the early preparation of environmental impact statements, and (2) for the referral to the Council of conflicts between agencies concerning the implementation of the National Environmental Policy Act of 1969, as amended, and

Section 309 of the Clean Air Act, as amended, for the Council's recommendation as to their prompt resolution.

(i) Issue such other instructions to agencies, and request such reports and other information from them, as may be required to carry out the Council's responsibilities under the Act.

(j) Assist the President in preparing the annual Environmental Quality Report provided for in section 201 of the Act.

(k) Foster investigations, studies, surveys, research, and analyses relating to (i) ecological systems and environmental quality, (ii) the impact of new and changing technologies thereon, and (iii) means of preventing or reducing adverse effects from such technologies.

SEC. 4. *Amendments of E.O. 11472.* Executive Order No. 11472 of May 29, 1969, including the heading thereof, is hereby amended:

(1) By substituting for the term "the Environmental Quality Council", wherever it occurs, the following: "the Cabinet Committee on the Environment".

(2) By substituting for the term "the Council", wherever it occurs, the following: "the Cabinet Committee".

(3) By inserting in subsection (f) of section 101, after "Budget", the following: "the Director of the Office of Science and Technology,".

(4) By substituting for subsection (g) of section 101 the following:

"(g) The Chairman of the Council on Environmental Quality (established by Public Law 91–190) shall assist the President in directing the affairs of the Cabinet Committee."

(5) By deleting subsection (c) of section 102.

(6) By substituting for "the Office of Science and Technology", in section 104, the following: "the Council on Environmental Quality (established by Public Law 91–190)".

(7) By substituting for "(hereinafter referred to as the 'Committee')", in section 201, the following: "(hereinafter referred to as the 'Citizens' Committee')".

(8) By substituting for the term "the Committee", wherever it occurs, the following: "the Citizens' Committee".

OIL POLLUTION OF THE OCEANS: THE PRESIDENT'S MESSAGE TO THE CONGRESS RECOMMENDING MEASURES TO CONTROL THE PROBLEM

To the Congress of the United States:

The recent series of oil tanker accidents in and near American waters is a grave reminder of the risks associated with marine transportation of oil. Though we can never entirely eliminate these risks, we can reduce them. Today I am announcing a diverse but interrelated group of measures designed to do so.

These measures are both international and domestic. Pollution of the oceans by oil is a global problem requiring global solutions. I intend to communicate directly with the leaders of a number of major maritime nations to solicit their support for international action. Oil pollution is also a serious domestic problem requiring prompt and effective action by the federal government to reduce the danger to American lives, the American economy, and American beaches and shorelines, and the steps I am taking will do this.

The following measures are designed to achieve three objectives: First, to reduce oil pollution caused by tanker accidents and by routine operational discharges from all vessels; Second, to improve our ability to deal swiftly and effectively with oil spills when they do occur; and Third, to provide full and dependable compensation to victims of oil pollution damage.

These are the measures I recommend:

- RATIFICATION of the International Convention for the Prevention of Pollution from Ships. I am transmitting this far-reaching and comprehensive treaty to the Senate for its advice and consent. This Convention, by imposing segregated ballast requirements for new large oil tankers and placing stringent controls on all oil discharges from ships, represents an important multilateral step toward reducing the risk of marine oil pollution. In the near future, I will submit implementing legislation to the Congress.
- REFORM of ship construction and equipment standards. I am instructing the Secretary of Transportation to develop new rules for oil tanker standards within 60 days. These regulations will apply to all oil tankers over 20,000 deadweight tons, U.S. and foreign, which call at American ports. These regulations will include:

—Double bottoms on all new tankers;
—Segregated ballast on all tankers;
—Inert gas systems on all tankers;

—Backup radar systems, including collision avoidance equipment, on all tankers; and

—Improved emergency steering standards for all tankers.

These requirements will be fully effective within five years. Where technological improvements and alternatives can be shown to achieve the same degree of protection against pollution, the rules will allow their use.

Experience has shown that ship construction and equipment standards are effective only if backed by a strong enforcement program. Because the quality of inspections by some nations falls short of U.S. practice, I have instructed the Department of State and the Coast Guard to begin diplomatic efforts to improve the present international system of inspection and certification. In addition, I recommend the immediate scheduling of a special international conference for late 1977 to consider these construction and inspection measures.

- **Improvement** of crew standards and training. I am instructing the Secretary of Transportation to take immediate steps to raise the licensing and qualification standards for American crews.

  The international requirements for crew qualifications, which are far from strict, will be dealt with by a major international conference we will participate in next year. I am instructing the Secretary of Transportation to identify additional requirements which should be discussed, and if not included, may be imposed by the United States after 1978 on the crews of all ships calling at American ports.
- **Development** of Tanker Boarding Program and U.S. Marine Safety Information System. Starting immediately, the Coast Guard will board and examine each foreign flag tanker calling at American ports at least once a year and more often if necessary. This examination will insure that the ship meets all safety and environmental protection regulations. Those ships which fail to do so may be denied access to U.S. ports or, in some cases, denied the right to leave until the deficiencies have been corrected. The information gathered by this boarding program will permit the Coast Guard to identify individual tankers having histories of poor maintenance, accidents, and pollution violations. We will also require that the names of tanker owners, major stockholders, and changes in vessel names be disclosed and included in this Marine Safety Information System.
- **Approval** of Comprehensive Oil Pollution Liability and Compensation Legislation. I am transmitting appropriate legislation to establish a single, national standard of strict liability for oil spills. This legislation is designed to replace the present fragmented, overlapping systems of federal and state liability laws and compensation funds. It will also create a $200 million fund to clean up oil spills and compensate victims for oil pollution damages.
- **Improvement** of federal ability to respond to oil pollution emergencies. I have directed the appropriate federal agencies, particularly the Coast Guard and the Environmental Protection Agency, in cooperation with state and local governments to improve our ability to contain and minimize the damaging effects of oil spills. The goal is an ability to respond within six hours to a spill of 100,000 tons.

Oil pollution of the oceans is a serious problem that calls for concentrated, energetic, and prompt attention. I believe these measures constitute an effective program to control it. My Administration pledges its best efforts, in cooperation with the international community, the Congress, and the public, to preserve the earth's oceans and their resources.

JIMMY CARTER

The White House,
March 17, 1977.

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APPENDIX C

THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969, AS AMENDED*

An Act to establish a national policy for the environment, to provide for the establishment of a Council on Environmental Quality, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "National Environmental Policy Act of 1969."

PURPOSE

Sec. 2. The purposes of this Act are: To declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality.

TITLE I

DECLARATION OF NATIONAL ENVIRONMENTAL POLICY

Sec. 101. (a) The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment, particularly the profound influences of population growth, high-density urbanization, industrial expansion, resource exploitation, and new and expanding technological advances and recognizing further the critical importance of restoring and maintaining environmental quality to the overall welfare and development of man, declares that it is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.

(b) In order to carry out the policy set forth in this Act, it is the continuing responsibility of the Federal Government to use all practicable means, consistent with other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may—

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*Pub. L. 91-190, 42 U.S.C. 4321-4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, and Pub. L. 94-83, August 9, 1975.

(1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;

(2) assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;

(3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;

(4) preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice;

(5) achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and

(6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

(c) The Congress recognizes that each person should enjoy a healthful environment and that each person has a responsibility to contribute to the preservation and enhancement of the environment.

Sec. 102. The Congress authorizes and directs that, to the fullest extent possible: (1) the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in this Act, and (2) all agencies of the Federal Government shall—

(a) Utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decisionmaking which may have an impact on man's environment;

(b) Identify and develop methods and procedures, in consultation with the Council on Environmental Quality established by title II of this Act, which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decisionmaking along with economic and technical considerations;

(c) Include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on—

(i) The environmental impact of the proposed action,

(ii) Any adverse environmental effects which cannot be avoided should the proposal be implemented,

(iii) Alternatives to the proposed action,

(iv) The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and

(v) Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

Prior to making any detailed statement, the responsible Federal official shall consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved. Copies of such statement and the comments and views of the appropriate Federal, State, and local agencies, which are authorized to develop and enforce environmental standards, shall be made available to the President, the Council on Environmental Quality and to the public as provided by section 552 of title 5, United States Code, and shall accompany the proposal through the existing agency review processes;

(d) Any detailed statement required under subparagraph (c) after January 1, 1970, for any major Federal action funded under a program of grants to States shall not be deemed to be legally insufficient solely by reason of having been prepared by a State agency or official, if:

(i) the State agency or official has statewide jurisdiction and has the responsibility for such action,

(ii) the responsible Federal official furnishes guidance and participates in such preparation,

(iii) the responsible Federal official independently evaluates such statement prior to its approval and adoption, and

(iv) after January 1, 1976, the responsible Federal official provides early notification to, and solicits the views of, any other State or any Federal land management entity of any action or any alternative thereto which may have significant impacts upon such State or affected Federal land management entity and, if there is any disagreement on such impacts, prepares a written assessment of such impacts and views for incorporation into such detailed statement.

The procedures in this subparagraph shall not relieve the Federal official of his responsibilities for the scope, objectivity, and content of the entire statement or of any other responsibility under this Act; and further, this subparagraph does not affect the legal sufficiency of statements prepared by State agencies with less than statewide jurisdiction.

(e) Study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources;

(f) Recognize the worldwide and long-range character of environmental problems and, where consistent with the foreign policy of the United States, lend appropriate support to initiatives, resolutions, and programs designed to maximize international cooperation in anticipating and preventing a decline in the quality of mankind's world environment;

(g) Make available to States, counties, municipalities, institutions, and individuals, advice and information useful in restoring, maintaining, and enhancing the quality of the environment;

(h) Initiate and utilize ecological information in the planning and development of resource-oriented projects; and

(i) Assist the Council on Environmental Quality established by title II of this Act.

Sec. 103. All agencies of the Federal Government shall review their present statutory authority, administrative regulations, and current policies and procedures for the purpose of determining whether there are any deficiencies or inconsistencies therein which prohibit full compliance with the purposes and provisions of this Act and shall propose to the President not later than July 1, 1971, such measures as may be necessary to bring their authority and policies into conformity with the intent, purposes, and procedures set forth in this Act.

Sec. 104. Nothing in section 102 or 103 shall in any way affect the specific statutory obligations of any Federal agency (1) to comply with criteria or standards of environmental quality, (2) to coordinate or consult with any other Federal or State agency, or (3) to act, or refrain from acting contingent upon the recommendations or certification of any other Federal or State agency.

Sec. 105. The policies and goals set forth in this Act are supplementary to those set forth in existing authorizations of Federal agencies.

TITLE II

COUNCIL ON ENVIRONMENTAL QUALITY

SEC. 201. The President shall transmit to the Congress annually beginning July 1, 1970, an Environmental Quality Report (hereinafter referred to as the "report") which shall set forth (1) the status and condition of the major natural, manmade, or altered environmental classes of the Nation, including, but not limited to, the air, the aquatic, including marine, estuarine, and fresh water, and the terrestrial environment, including, but not limited to, the forest, dryland, wetland, range, urban, suburban and rural environment; (2) current and foreseeable trends in the quality, management and utilization of such environments and the effects of those trends on the social, economic, and other requirements of the Nation; (3) the adequacy of available natural resources for fulfilling human and economic requirements of the Nation in the light of expected population pressures; (4) a review of the programs and activities (including regulatory activities) of the Federal Government, the State and local governments, and nongovernmental entities or individuals with particular reference to their effect on the environment and on the conservation, development and utilization of natural resources; and (5) a program for remedying the deficiencies of existing programs and activities, together with recommendations for legislation.

SEC. 202. There is created in the Executive Office of the President a Council on Environmental Quality (hereinafter referred to as the "Council"). The Council shall be composed of three members who shall be appointed by the President to serve at his pleasure, by and with the advice and consent of the Senate. The President shall designate one of the members of the Council to serve as Chairman. Each member shall be a person who, as a result of his training, experience, and attainments, is exceptionally well qualified to analyze and interpret environmental trends and information of all kinds; to appraise programs and activities of the Federal Government in the light of the policy set forth in title I of this Act; to be conscious of and responsive to the scientific, economic, social, esthetic, and cultural needs and interests of the Nation; and to formulate and recommend national policies to promote the improvement of the quality of the environment.

SEC. 203. The Council may employ such officers and employees as may be necessary to carry out its functions under this Act. In addition, the Council may employ and fix the compensation of such experts and consultants as may be necessary for the carrying out of its functions under this Act, in accordance with section 3109 of title 5, United States Code (but without regard to the last sentence thereof).

SEC. 204. It shall be the duty and function of the Council—

(1) to assist and advise the President in the preparation of the Environmental Quality Report required by section 201 of this title;

(2) to gather timely and authoritative information concerning the conditions and trends in the quality of the environment both current and prospective, to analyze and interpret such information for the purpose of determining whether such conditions and trends are interfering, or are likely to interfere, with the achievement of the policy set forth in title I of this Act, and to compile and submit to the President studies relating to such conditions and trends;

(3) to review and appraise the various programs and activities of the Federal Government in the light of the policy set forth in title I of this Act for the purpose of determining the extent to which such programs and activities are contributing to the achievement of such policy, and to make recommendations to the President with respect thereto;

(4) to develop and recommend to the President national policies to foster and promote the improvement of environmental quality to meet the conservation, social, economic, health, and other requirements and

goals of the Nation;

(5) to conduct investigations, studies, surveys, research, and analyses relating to ecological systems and environmental quality;

(6) to document and define changes in the natural environment, including the plant and animal systems, and to accumulate necessary data and other information for a continuing analysis of these changes or trends and or interpretation of their underlying causes;

(7) to report at least once each year to the President on the state and condition of the environment; and

(8) to make and furnish such studies, reports thereon, and recommendations with respect to matters of policy and legislation as the President may request.

SEC. 205. In exercising its powers, functions, and duties under this Act, the Council shall—

(1) Consult with the Citizens' Advisory Committee on Environmental Quality established by Executive Order No. 11472, dated May 29, 1969, and with such representatives of science, industry, agriculture, labor, conservation organizations, State and local governments and other groups, as it deems advisable; and

(2) Utilize, to the fullest extent possible, the services, facilities and information (including statistical information) of public and private agencies and organizations, and individuals, in order that duplication of effort and expense may be avoided, thus assuring that the Council's activities will not unnecessarily overlap or conflict with similar activities authorized by law and performed by established agencies.

SEC. 206. Members of the Council shall serve full time and the Chairman of the Council shall be compensated at the rate provided for Level II of the Executive Schedule Pay Rates (5 U.S.C. 5313). The other members of the Council shall be compensated at the rate provided for Level IV of the Executive Schedule Pay Rates (5 U.S.C. 5315).

SEC. 207. The Council may accept reimbursements from any private nonprofit organization or from any department, agency, or instrumentality of the Federal Government, any State, or local government, for the reasonable travel expenses incurred by an officer or employee of the Council in connection with his attendance at any conference, seminar, or similar meeting conducted for the benefit of the Council.

SEC. 208. The Council may make expenditures in support of its international activities, including expenditures for: (1) international travel; (2) activities in implementation of international agreements; and (3) the support of international exchange programs in the United States and in foreign countries.

SEC. 209. There are authorized to be appropriated to carry out the provisions of this chapter not to exceed $300,000 for fiscal year 1970, $700,000 for fiscal year 1971, and $1,000,000 for each fiscal year thereafter.

THE ENVIRONMENTAL QUALITY IMPROVEMENT ACT OF 1970*

TITLE II—ENVIRONMENTAL QUALITY (OF THE WATER QUALITY IMPROVEMENT ACT OF 1974)

SHORT TITLE

SEC. 201. This title may be cited as the "Environmental Quality Improvement Act of 1970."

FINDINGS, DECLARATIONS, AND PURPOSES

SEC. 202. (a) The Congress finds—

(1) That man has caused changes in the environment;

(2) That many of these changes may affect the relationship between man and his environment; and

(3) That population increases and urban concentration contribute directly to pollution and the degradation of our environment.

(b)(1) The Congress declares that there is a national policy for the environment which provides for the enhancement of environmental quality. This policy is evidenced by statutes heretofore enacted relating to the prevention, abatement, and control of environmental pollution, water and land resources, transportation, and economic and regional development.

(2) The primary responsibility for implementing this policy rests with State and local governments.

(3) The Federal Government encourages and supports implementation of this policy through appropriate regional organizations established under existing law.

(c) The purposes of this title are—

(1) To assure that each Federal department and agency conducting or supporting public works activities which affect the environment shall implement the policies established under existing law; and

(2) To authorize an Office of Environmental Quality, which, notwithstanding any other provision of law, shall provide the professional and administrative staff for the Council on Environmental Quality established by Public Law 91-190.

OFFICE OF ENVIRONMENTAL QUALITY

SEC. 203. (a) There is established in the Executive Office of the President an office to be known as the Office of Environmental Quality (hereafter in this title referred to as the "Office"). The Chairman of the Council on Environmental Quality established by Public Law 91–190 shall be the Director of the Office. There shall be in the Office a Deputy Director who shall be appointed by the President, by and with the advice and consent of the Senate.

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*Pub. L. 91-224, 42 U.S.C. 4371-4374, April 3, 1970.

(b) The compensation of the Deputy Director shall be fixed by the President at a rate not in excess of the annual rate of compensation payable to the Deputy Director of the Bureau of the Budget.

(c) The Director is authorized to employ such officers and employees (including experts and consultants) as may be necessary to enable the Office to carry out its functions under this title and Public Law 91–190, except that he may employ no more than 10 specialists and other experts without regard to the provisions of title 5, United States Code, governing appointments in the competitive service, and pay such specialists and experts without regard to the provisions of chapter 51 and subchapter III of chapter 53 of such title relating to classification and General Schedule pay rates, but no such specialist or expert shall be paid at a rate in excess of the maximum rate for GS–18 of the General Schedule under section 5330 of title 5.

(d) In carrying out his functions the Director shall assist and advise the President on policies and programs of the Federal Government affecting environmental quality by—

(1) Providing the professional and administrative staff and support for the Council on Environmental Quality established by Public Law 91–190;

(2) Assisting the Federal agencies and departments in appraising the effectiveness of existing and proposed facilities, programs, policies, and activities of the Federal Government, and those specific major projects designated by the President which do not require individual project authorization by Congress, which affect environmental quality;

(3) Reviewing the adequacy of existing systems for monitoring and predicting environmental changes in order to achieve effective coverage and efficient use of research facilities and other resources;

(4) Promoting the advancement of scientific knowledge of the effects of actions and technology on the environment and encourage the development of the means to prevent or reduce adverse effects that endanger the health and well-being of man;

(5) Assisting in coordinating among the Federal departments and agencies those programs and activities which affect, protect, and improve environmental quality;

(6) Assisting the Federal departments and agencies in the development and interrelationship of environmental quality criteria and standards established through the Federal Government;

(7) Collecting, collating, analyzing, and interpreting data and information on environmental quality, ecological research, and evaluation.

(e) The Director is authorized to contract with public or private agencies, institutions, and organizations and with individuals without regard to sections 3618 and 3709 of the Revised Statutes (31 U.S.C. 529; 41 U.S.C. 5) in carrying out his functions.

REPORT

Sec. 204. Each Environmental Quality Report required by Public Law 91–190 shall, upon transmittal to Congress, be referred to each standing committee having jurisdiction over any part of the subject matter of the Report.

AUTHORIZATION

Sec. 205. There are hereby authorized to be appropriated not to exceed $500,000 for the fiscal year ending June 30, 1970, not to exceed $750,000 for the fiscal year ending June 30, 1971, not to exceed $1,250,000 for the fiscal year ending June 30, 1972, and not to exceed $1,500,000 for the fiscal year ending June 30, 1973. These authorizations are in addition to those contained in Public Law 91–190.

Approved April 3, 1970.

CEQ STUDIES*

Report to the President on Environmental Impacts Of Proposed Alaska Gas Transportation Corridors

On July 1, 1977, the Council submitted to the President its report on the environmental impacts of alternate proposals for delivering North Slope natural gas to the lower 48 states. The report, required by the Alaska Natural Gas Transportation Act of 1976, analyzed the environmental impact statements prepared on three major proposals. Of the three, the Alcan route—afterwards selected by the President and the government of Canada—was the most environmentally acceptable. Available from CEQ.

Hard Rock Mining on the Public Land

The Mining Law of 1872, still in force today for hard rock minerals, has the single purpose of promoting private exploration for minerals on public lands. Among objectives which it does not consider are multiple use, environmental protection, a fair market return to the public, retention of public ownership, efficient allocation of resources, energy conservation, and competition in the mineral industry. This short study gives a context to the law's inadequacies, synthesizes varying opinions, and analyzes government policy toward hard rock mining on federal lands. The report was written by David Sheridan and illustrated by Margaret Lizbeth Carr. Available from GPO.

Oil and Gas in Coastal Lands and Waters

How to protect the natural and human environments of the seacoast while making room for essential new energy systems is the subject of this study, which was written by Katherine Gillman and illustrated by Allen Carroll. It discusses oil spills; other impacts of oil and gas drilling; tankers and supertankers; safety of LNG; impacts of onshore energy developments on air, water, and the use of land; and socioeconomic effects of these developments. The report draws upon the experience of coastal communities here and abroad and points out ways for communities to guide onshore development in accordance with their own needs and values. Available from GPO.

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*When requesting studies from CEQ, 722 Jackson Pl. N.W., Washington, D.C. 20006, please enclose a self-addressed pressure-sensitive label. Reports may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, and from National Technical Information Service, U.S. Department of Commerce, Springfield, Va. 22161.

Our Nation's Wetlands: An Interagency Task Force Report

This comprehensive study defines wetlands, explains their natural functions and values, discusses their alteration or destruction for various human purposes, and comments on our evolving national wetlands policy. Using case reports, the study examines wetland production, pollution control, and flood damage protection. Alteration of wetlands for agriculture, homes, highways, and other uses are discussed and illustrated. Eleanor Lander Horowitz is the author, Allen Carroll is designer, and he and Richard Brown are the illustrators. CEQ coordinated the Task Force, composed of the Environmental Protection Agency; Department of the Army, U.S. Corps of Engineers; Department of the Interior, U.S. Fish and Wildlife Service; Department of Agriculture, Soil Conservation Service and Forest Service; and Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. To be available from GPO.

The Evolution of Wildlife Law

Since 1842 when the Supreme Court declared that wildlife was held in trust for all citizens, federal involvement in protecting and conserving wildlife has steadily grown. Today more than 100 treaties, federal laws, Executive orders, and regulations are interpreted and enforced by many public authorities. The report describes these interrelated, sometimes overlapping laws and regulations and offers proposals for improvement. Prepared under contract with the Environmental Law Institute, the report was written by Michael J. Bean. Available from GPO.

Wildlife and America

This compendium covers the range of U.S. wildlife topics, with sections on the values and uses of wildlife, modification of habitat, stress from human activities, legal and political authority affecting wildlife management, protection of habitat, and support of wildlife conservation. Beginning with a description of the richness of American wildlife before European settlement, the book proceeds to discuss such issues as the effect of agriculture and forestry on wildlife, the pressures of urbanization, federal wildlife law, political requirements for preserving our wildlife heritage, and the maintenance of wildlife populations. Howard P. Brokaw is the editor. The papers were presented at a symposium held in Washington, D.C. in September 1976. The symposium and book were sponsored by CEQ; the Department of Commerce, National Oceanic and Atmospheric Administration; the Department of the Interior, Fish and Wildlife Service; and the Department of Agriculture, Forest Service. To be available from GPO.

Off-Road Vehicles on the Public Lands

Motorized off-road vehicles are proliferating. Motorcycles, trail bikes, dune buggies, and snowmobiles are being used on federal lands and in many cases are causing serious environmental damage to deserts, grasslands, and forest. This study will document the environmental problems and examine ways to implement Executive orders designed to protect the public lands from off-road vehicle abuse. It is being written by David Sheridan.

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Global Population, Natural Resources, And Environment in the Year 2000

Using existing modeling tools, this interagency study, directed by CEQ and the Department of State, makes integrated projections of the world's population, resources, and environment through the century. Scarcities that may be serious by the year 2000 and beyond are being identified, as are research needs and priorities. The study will serve as a basis for long-range planning by government agencies and private organizations.

Integrated Pest Management: Status and Prospects in the United States

This report will update the 1972 Council study. It discusses the prospects of this ecological approach to pest control for agriculture, livestock and pets, forestry, urban areas, households, and public health and will make recommendations for federal action to increase the use of integrated pest management.

Pest Control Strategies

These papers, presented at a symposium sponsored by CEQ and EPA at Cornell University in June 1977, describe alternative pest control strategies, present integrated pest management case studies for a number of crops, and identify possible actions to encourage broader use of ecologically sound pest control strategies. Available from NTIS and Academic Press.

Environmental Effects of Increased Coal Use, Two Reports

Increased coal use threatens the clean air and visibility in National Parks and Wilderness Areas. In the first of two studies, "A Technical Analysis of Methods for Assessing Visibility Impairment Caused by Air Pollutants," the University of Washington Institute for Environmental Studies evaluates the technical problems of measuring visibility impairment and recommends methods for enforcing visibility standards. Acid rain is another potential adverse impact. In "A Research Plan on Atmospheric Deposition (Acid Rain)," two research scientists from the University of Virginia and North Carolina State University are developing a 5-year research plan to study the problem.

Photochemical Oxidant Air Pollution, Three Studies

In the first of three studies, *Factors Affecting the Design of Oxidant Control Strategies*, Batelle Columbus Laboratories investigates how hydrocarbons emitted by industrial and transportation sources should be classified in terms of their contribution to photochemical oxidant (smog) formation. In the second study, *An Investigation of the Effect of the Temporal and Spatial Variation of Hydrocarbon Emissions upon Hydrocarbon Concentrations*, Systems Applications, Inc., evaluates the technical and practical aspects of a proposed model to be used in developing photochemical oxidant control strategies. In the third, *A Preliminary Evaluation of the Potential Influence of Varying HC/NO_x Ratios on the Design of Oxidant Control Strategies*, Engineering-Science studies the effect of predicted changes in the location and time of day of emissions on smog formation levels. The changeover to the catalytic converter has a significant influence on control requirement estimates because of the change in their emission pattern. Available from NTIS.

Review of Federal Programs Funding Waste Water Treatment Facilities, Two Papers

In the first of these papers, ***National Wildlife Federation Review of EPA 201 Wastewater Treatment Facility Grant Program Documents,*** John M. Fishman and Thomas K. Bick evaluated EPA's 201 Wastewater Treatment Facility Grant Program for land use impacts, compliance with NEPA, and adequacy of public participation. They review EPA's compliance with federal policy to protect wetlands and coastal floodplains and coordination between Section 201 wastewater facility planning and Section 208 water quality management planning. In the second paper, ***Water and Sewer Funding Programs at FmHA, EDA, and HUD: A Survey of Environmental Implications,*** Phyllis Slesinger considers the land use effects and other environmental implications of the water and sewer funding programs of the Farmers Home Administration, HUD, and the Economic Development Administration. Available from NTIS.

The Boston Case Study, Two Reports

The first of these reports, "Water Quality Goals and Objectives," by Environmental Research and Technology, Inc., evaluates Boston's water quality plans. The second, "Political and Institutional Issues," by Urban Systems Research and Engineering, Inc., studies the institutional factors that significantly shape Boston's wastewater management process. This case study, sequel to a similar study of the Sacramento area, was sponsored by CEQ, EPA, NSF, and OMB.

Environmental Mediation

Sponsored by CEQ and the U.S. Geological Survey, the American Arbitration Association study will conclude with production of a handbook describing the kinds of disputes that are most suitable for environmental mediation.

APPENDIX F

MEMORANDUM FOR HEADS OF AGENCIES: ANALYSIS OF IMPACTS ON PRIME AND UNIQUE FARMLAND IN ENVIRONMENTAL IMPACT STATEMENTS

August 30, 1976

This memorandum provides guidance to Federal agencies on how to evaluate the impact of agency actions on prime or unique farmland in the course of preparing environmental impact statements (EIS).*

Paragraph 101(b)(4) of the National Environmental Policy Act (NEPA) establishes a Federal policy to preserve important historic, cultural and natural aspects of our national heritage and maintain, wherever possible, an environment which supports diversity and variety of individual choice. This policy should be understood to include highly productive farmlands.

Efforts should be made to assure that such farmlands are not irreversibly converted to other uses unless other national interests override the importance of preservation or otherwise outweigh the environmental benefits derived from their protection. These benefits stem from the capacity of such farmland to produce relatively more food with less erosion and with lower demands for fertilizer, energy, and other resources. In addition, the preservation of farmland provides the benefits of open space, protection of scenery, wildlife habitat and, in some cases, recreation opportunities and controls on urban sprawl.

As part of its policy to preserve the Nation's prime farm, range, and forest lands, the Department of Agriculture (USDA) has recently announced a general policy to establish and keep current an inventory of prime and unique farmland. Recent estimates conclude that of 1.4 billion acres of privately owned lands in the United States, approximately 275 million acres are classed as prime or unique farmlands.

Federal agencies should determine the existence of prime and unique farmlands in the areas of impact analyzed in environmental impact statements prepared in compliance with Section 102(2)(C) of NEPA. This should include threats to the continued use and viability of these farmlands not only from direct construction activities, but also from urbanization or other changes in land use that might be induced by the Federal action.

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*Prime farmlands are those whose value derives from their general advantage as cropland due to soil and water conditions. Unique farmlands are those whose value derives from their particular advantages for growing specialty crops.

The Department of Agriculture, at its field locations throughout the country, is committed to assisting Federal agencies in the identification of prime or unique farmlands, and in nearly all cases has complete information on land areas which may be affected. This should simplify and reduce the burden on other agencies in carrying out their impact analysis. Initial contact should be made with the USDA Land Use Committee in the state where the lands under consideration are situated. The Committee can be located by contacting either the Chairman of the USDA Rural Development Committee in the state or any nearby USDA office. The State Land Use Committee will then help facilitate contacts with the appropriate USDA office so that all available information on prime and unique farmlands within the project area is accessible to the agency preparing an EIS.

Finally, the Department of Agriculture has agreed to place a major new emphasis on the review and evaluation of draft environmental impact statements for impacts on prime and unique farmland. USDA will use soil, range, forest, water resource, and other applicable surveys and information. Thus the Department should help improve the quality of all EISs that involve agricultural lands.

Further information on where agencies may obtain assistance in identifying prime and unique farmland and analyzing significant impacts from agency activities can be obtained from State Soil Conservation Service (SCS) offices shown on the attachment. Information on new USDA procedures to review impacts on prime and unique farmlands in draft EISs can also be obtained from these sources.

RUSSELL W. PETERSON
Chairman

Attachment

STATE CONSERVATIONISTS

William B. Lingle
Wright Building
138 South Gay Street
P.O. Box 311
ALABAMA, Auburn 36830
Phone: 534–4535 (FTS)
205–821–8070 (CML)

Weymeth E. Long
204 East Fifth Avenue
Room 217
ALASKA, Anchorage 99501
Phone: 907-274-7626 (FTS & CML)

Thomas G. Rockenbaugh
230 N. 1st Avenue
6029 Federal Building
ARIZONA, Phoenix 85025
Phone: 602-261-3271 (FTS & CML)

Maurice J. Spears
Federal Building, Room 5029
700 West Capitol Street
P.O. Box 2323
ARKANSAS, Little Rock 72203
Phone: 740–5445 (FTS)
501–378–5445 (CML)

George H. Stone, Jr.
2828 Chiles Road
CALIFORNIA, Davis 95616
Phone: 916–758–2200 ext. 210 (FTS & CML)

Merritt D. Burdick
Room 313
2490 West 26th Avenue
P.O. Box 17107
COLORADO, Denver 80217
Phone: 327–4275 (FTS)
303–837–3947 (CML)

Robert G. Halstead
Mansfield Professional Park
Route 44A
CONNECTICUT, Storrs 06268
Phone: 244–2547/2548 (FTS)
203–429–9361/9362 (CML)

Otis D. Fincher
Treadway Towers, Suite 2–4
9 East Loockerman Street
DELAWARE, Dover 19901
Phone: 487–5148 (FTS)
302–678–0750 (CML)

William E. Austin
Federal Building
P.O. Box 1208
FLORIDA, Gainesville 32601
Phone: 946–3871 ext. 100 (FTS)
904–377–8732 (CML)

Dwight M. Treadway
Federal Building
355 E. Hancock Avenue
P.O. Box 832
GEORGIA, Athens 30601
Phone: 289–2275 (FTS)
404–546–2273 (CML)

Francis C. H. Lum
440 Alexander Young Bldg.
HAWAII, Honolulu 96813
Phone: 808–546–3165 (FTS & CML)

Amos I. Garrison, Jr.
Room 345
304 North 8th Street
IDAHO, Boise 83702
Phone: 588–2601 (FTS)
208–342–2711 ext. 2601 (CML)

Daniel E. Holmes
Federal Building
200 W. Church Street
P.O. Box 678
ILLINOIS, Champaign 61820
Phone: 958–9147/9125 (FTS)
217–356–3785 (CML)

Cletus J. Gillman
Atkinson Square-West
Suite 2200
5610 Crawfordsville Road
INDIANA, Indianapolis 46224
Phone: 331–6515 (FTS)
317–269–6515 (CML)

William J. Brune
823 Federal Building
210 Walnut Street
IOWA, Des Moines 50309
Phone: 515–284–4260 (FTS & CML)

Robert K. Griffin
760 South Broadway
P.O. Box 600
KANSAS, Salina 67401
Phone: 752–9728 (FTS)
913–825–9535 (CML)

Glen E. Murray
333 Waller Avenue
KENTUCKY, Lexington 40504
Phone: 355–2749 (FTS)
606–252–2312 ext. 2749 (CML)

Alton Mangum
3737 Government Street
P.O. Box 1630
LOUISIANA, Alexandria 71301
Phone: 497–6611 ext. 233 (FTS)
318–448–3421 (CML)

Warwick M. Tinsley, Jr.
USDA Building
University of Maine
MAINE, Orono 04473
Phone: 833–7393 (FTS)
207–866–2132/2133 (CML)

Graham T. Munkittrick
Room 522, Hartwick Building
4321 Hartwick Road
MARYLAND, College Park 20740
Phone: 301–344–4180 (FTS & CML)

Benjamin Isgur
29 Cottage Street
MASSACHUSETTS, Amherst 01002
Phone: 413–549–0650 (FTS & CML)

Arthur H. Cratty
1405 Harrison Road
MICHIGAN, East Lansing 48823
Phone: 374–4242 (FTS)
517–372–1910 ext. 242 (CML)

Harry M. Major
200 Federal Bldg. and U.S. Courthouse
316 North Robert Street
MINNESOTA, St. Paul 55101
Phone: 612–725–7675 (FTS & CML)

William L. Heard
Milner Building, Room 590
P.O. Box 610
MISSISSIPPI, Jackson 39205
Phone: 490–4335 (FTS)
601–969–4330 (CML)

Kenneth G. McManus
Parkade Plaza Shopping Center (Terrace Level)
P.O. Box 459
MISSOURI, Columbia 65201
Phone: 276–3145 (FTS)
314–442–2271 ext. 3155 (CML)

Van K. Haderlie
Federal Building
P.O. Box 970
MONTANA, Bozeman 59715
Phone: 585–4322 (FTS)
406–587–5271 ext. 4322 (CML)

Wilson J. Parker
Federal Bldg.-U.S. Courthouse Room
100 Centennial Mall, North
NEBRASKA, Lincoln 68508
Phone: 867–5301 (FTS)
402–471–5301 (CML)

Gerald C. Thola
U.S. Post Office Building
P.O. Box 4850
NEVADA, Reno 89505
Phone: 598–5304 (FTS)
702–784–5304 (CML)

Donald G. Burbank
Federal Building
NEW HAMPSHIRE, Durham 03824
Phone: 834–0505 (FTS)
603–868–7581 (CML)

Chester F. Bellard
1370 Hamilton Street
P.O. Box 219
NEW JERSEY, Somerset 08873
Phone: 342–5225 (FTS)
201–246–1205 ext. 20 (CML)

Albert W. Hamelstrom
517 Gold Avenue, SW
P.O. Box 2007
NEW MEXICO, Albuquerque 87103
Phone: 474–2173 (FTS)
505–766–2173 (CML)

Robert L. Hilliard
Midtown Plaza—Room 400
700 East Water Street
NEW YORK, Syracuse 13210
Phone: 951–3530 (FTS)
315–473–3530 (CML)

Jesse L. Hicks
Federal Office Building
Fifth Floor—P.O. Box 27307
NORTH CAROLINA, Raleigh
27611
Phone: 672–4210 (FTS)
919–755–4165 (CML)

Allen L. Fisk
Federal Building
P.O. Box 1458
NORTH DAKOTA, Bismarck 58501
Phone: 783–4421 (FTS)
701–255–4011 ext. 421
(CML)

Robert E. Quilliam
311 Old Federal Building
3rd & State Streets
OHIO, Columbus 43215
Phone: 943–6785 (FTS)
614–469–6785 (CML)

Roland R. Willis
Agriculture Building
Farm Road & Brumley Street
OKLAHOMA, Stillwater 74074
Phone: 743–4204 (FTS)
405–372–7111 ext. 204
(CML)

Guy W. Nutt
Washington Building
1220 S.W. Washington Street
OREGON, Portland 97204
Phone: 432–2751 (FTS)
503–221–2751 (CML)

Benny Martin
Federal Bldg. & Courthouse
Box 985 Federal Square Station
PENNSYLVANIA, Harrisburg 1710
Phone: 590–2297 (FTS)
717–782–4403 (CML)

Angel H. Quintero
Caribbean Area
1409 Ponce de Leon Avênue,
STOP 20
PUERTO RICO, Santurce 00907
Mailing address: GPO Box 4868
PUERTO RICO, San Juan 00936
Phone: 809–725–8966 (FTS & CML)

Austin L. Patrick, Jr.
222 Quaker Lane
RHODE ISLAND, West Warwick
02893
Phone: 401–828–1300 (FTS & CML)

George E. Huey
Federal Building
901 Sumter Street
SOUTH CAROLINA, Columbia
29201
Phone: 677–5681 (FTS)
803–765–5681 (CML)

Vincent W. Shally
239 Wisconsin Avenue, SW
P.O. Box 1357
SOUTH DAKOTA, Huron 57350
Phone: 782–2333 (FTS)
605–352–8651 (CML)

Donald C. Bivens
561 U.S. Courthouse
TENNESSEE, Nashville 37203
Phone: 852–5471 (FTS)
615–749–5471 (CML)

George C. Marks
16–20 South Main Street
P.O. Box 648
TEXAS, Temple 76501
Phone: 736–1214 (FTS)
817–773–1711 ext. 331
(CML)

George D. McMillan
4012 Federal Building
125 South State Street
UTAH, Salt Lake City 84138
Phone: 588–5050 (FTS)
801–524–5051 (CML)

Craig M. Right
Burlington Square, Suite 205
VERMONT, Burlington 05401
Phone: 832–6501 (FTS)
802–862–6501 ext. 6261
(CML)

David N. Grimwood
Federal Bldg., Room 9201
400 N. 8th Street
P.O. Box 10026
VIRGINIA, Richmond 23240
Phone: 925–2457 (FTS)
804–782–2457 (CML)

Galen S. Bridge
360 U.S. Courthouse
W. 920 Riverside Avenue
WASHINGTON, Spokane 99201
Phone: 439–3711 (FTS)
509–456–3711 (CML)

James S. Bennett
75 High Street
P.O. Box 865
WEST VIRGINIA, Morgantown 26505
Phone: 923–7151 (FTS)
304–599–7151 (CML)

Jerome C. Hytry
4601 Hammersley Road
P.O. Box 4248
WISCONSIN, Madison 53711
Phone: 364–5351 (FTS)
608–252–5351 (CML)

Blaine O. Halliday
Federal Office Building
P.O. Box 2440
WYOMING, Casper 82601
Phone: 328–5201 (FTS)
307–265–5550 ext. 3217 (CML)

APPENDIX G

MEMORANDA TO HEADS OF AGENCIES REGARDING ENVIRONMENTAL IMPACTS ABROAD

MEMORANDUM TO HEADS OF AGENCIES ON APPLYING THE EIS REQUIREMENT TO ENVIRONMENTAL IMPACTS ABROAD

SEPTEMBER 24, 1976

In recent months the Council has been involved in discussions with several agencies concerning the application of the EIS requirement in NEPA to U.S. actions with significant environmental impacts abroad (the high seas, the atmosphere, and other areas outside the jurisdiction of any nation; and other countries). We have noted different interpretations and practices among several agencies on this issue, and consequently have seen impact statements filed which reflect varying degrees of consideration of the impacts abroad of U.S. actions (whether the actions are taken or the decisions made in the United States or abroad).

In order to encourage a consistent application of NEPA to all major federal actions, the Council is issuing the attached Memorandum on the Application of the EIS Requirement to Environmental Impacts Abroad. In it, we advise that NEPA requires analysis and disclosure in environmental statements of significant impacts of federal actions on the human environment—in the United States, in other countries, and in areas outside the jurisdiction of any country.

We believe that by taking account of likely impacts abroad before deciding on a proposal for action, federal agencies can obtain the same benefits of NEPA review that accompany the development of projects or actions with domestic impacts. Moreover, we believe such analyses can be accomplished without imposing U.S. environmental standards on other countries, and without interfering with the execution of foreign policy. To the contrary, such analysis and disclosure can provide useful information to cooperating governments. Finally, if agencies undertake these analyses in cooperation with involved foreign governments, U.S. agencies can promote international approaches to environmental protection as recommended in the Stockholm Declaration and elsewhere.

We recommend that agencies which take actions abroad and/or which take actions in the United States with potential significant environmental impacts abroad consult as necessary with the Council or Council's staff concerning specific procedures, proposals or programs which may be affected.

RUSSELL W. PETERSON
Chairman

MEMORANDUM ON THE APPLICATION OF THE EIS REQUIREMENT TO ENVIRONMENTAL IMPACTS ABROAD OF MAJOR FEDERAL ACTIONS

SEPTEMBER 24, 1976

NEPA requires analysis of significant environmental impacts of proposed major federal actions on the quality of the human environment. The "human environment" is not limited to the United States, but includes other countries and areas outside the jurisdiction of any country (e.g., the high seas, the atmosphere). The Act contains no express or implied geographic limitation of environmental impacts to the United States or to any other area. Indeed, such a limitation would be inconsistent with the plain language of NEPA, its legislative purpose, the Council's Guidelines, and judicial precedents.

In a statute which in other sections refers specifically to the *national* environment,[1] use of the term *human* environment in § 102(2)(C) reflects an intent to cover environmental impacts beyond U.S. borders. This interpretation is consistent with NEPA's stated purpose, declared in the preamble to the Act, to "encourage productive and enjoyable harmony between *man and his environment;* to promote efforts which will prevent or eliminate damage to *the environment and biosphere* and stimulate the *health and welfare of man.*" It is also consistent with Congress' recognition in Section 101 of "the profound impact of man's activity on the interrelations of *all components of the natural environment* . . . and . . . the critical importance of restoring and maintaining environmental quality to the *overall welfare and development of man.*" Applying the EIS requirement to impacts abroad also implements the mandate in Section 102 to all agencies to "recognize the *worldwide* and long range character of environmental problems." In sum, the broad language of Section 102(2)(C) as well as the explicit congressional determination that our national environmental policy must have a global perspective gives Section 102(2)(C) a wide scope.

The legislative history of NEPA supports the inclusion of impacts globally and in other countries within the scope of the EIS requirement. A 1968 "Congressional White Paper on a National Policy for the Environment", summarizing the joint House-Senate colloquium on national environmental policy that led to NEPA's introduction, and inserted into the record by Senator Jackson during debate, stated, "[a]lthough the influence of the U.S. policy will be limited outside its own borders, the global character of ecological relationships must be the guide for domestic activities."[2] Both the House and the Senate reports on NEPA, reflecting the testimony of numerous witnesses at the hearings, recognized the statute's global perspective.[3] Statements to the same effect were made during the floor debates, including an explanation by Senator Jackson of NEPA's statement of environmental policy:

"What is involved [in NEPA] is a congressional declaration that we do not intend, as a government or as a people, to initiate actions which endanger the continued existence or the health of mankind: That we will not intentionally initiate action which will do irreparable damage to the air, land and water which support life on earth." [4]

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[1] See, e.g., Sections 101(b), (2), 101(b)(4), 201.

[2] 115 Cong. Rec. 29082 (Oct. 8, 1969).

[3] See, e.g., Sen. Rep. No. 91-296, 91st Cong. 1st Sess., at 17, 43–45 (1969); H.R. Rep. No. 91-378, 91st Cong., 1st Sess., at 5, 7 (1969).

The House Merchant Marine and Fisheries Committee during oversight hearings specifically rejected the argument that NEPA should not be applied to actions occurring within the jurisdiction of another nation:

"Stated most charitably, the committee disagrees with this interpretation of NEPA. The history of the act makes it quite clear that the global effects of environmental decisions are inevitably a part of the decisionmaking process and must be considered in that context.[5]

The Council has consistently applied NEPA to U.S. international activities and has urged federal agencies to recognize the Act's global perspective. In its first Annual Report, for example, the Council pointed out that NEPA "directed all agencies of the Federal Government to recognize the worldwide and long-range character of environmental problems." [6] In 1971 the Council's Legal Advisory Committee specifically urged federal agencies to apply NEPA to their actions in foreign countries.[7] The Council's 1973 Guidelines require the assessment of "both the national and international environment." [8] The Fifth Annual Report reviewed agencies' experience in applying the EIS process to U.S. actions abroad.[9] In 1976 the Council reported on one of the benefits of this experience—the growth of environmental impact assessment procedures in other countries.[10]

Accordingly, some federal agencies have provided in their NEPA procedures for the preparation of environmental statements when agency actions cause significant environmental impacts beyond U.S. borders,[11] and impact statements have been prepared on U.S. actions in foreign countries.[12] Moreover, the courts [13] and virtually every legal commentary addressing the subject[14] have supported the Council's belief that an environmental statement is required whenever U.S. actions would have significant environmental impacts on the U.S., on global resources, or on foreign countries.

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[4] 115 Cong. Rec. 19009 (July 10, 1969); see also 115 Cong. Rec. 14347 (May 29, 1969); 115 Cong. Rec. 26575–16476 (Sept. 23, 1969); 115 Cong. Rec. 29056 (Oct. 8, 1969).

[5] H.R. Rep. 92–316, 92nd Cong., 1st Sess., at 32–33 (1971).

[6] CEQ, *Environmental Quality—1970*, at 200 (1970).

[7] Legal Advisory Committee Report to the President's Council on Environmental Quality, at 13–17 (December 1971).

[8] 40 C.F.R. Section 1500, 8(a)(3)(i) (1975).

[9] CEQ, *Environmental Quality—1974*, at 399–400 (1974).

[10] CEQ, *Environmental Quality—1975*, at 653–54 (1976).

[11] See, e.g., 38 *Fed. Reg.* 34135–46 (1973) (Coast Guard); 37 *Fed. Reg.* 19167–68 (1972) (Dept. of State); 41 *Fed. Reg.* 26913–26919 (1976) (Agency for International Development).

[12] See, e.g., Dept. of Transportation, Draft EIS, Darien Gap Highway (March 1976); Dept. of the Interior, Final EIS, Alaska Natural Gas Transportation System (March 1975).

[13] In *Wilderness Society v. Morton*, 463 F. 2d 1261 (D.C. Cir. 1972), the court granted standing to Canadian intervenors concerned with the trans-Alaska Pipeline, holding that the intervenors' interest in the significant impacts of the pipeline in Canada were within the zone protected by Section 102(2)(c). In *Sierra Club v. Coleman*, 405 F. Supp. 53 (D.D.C. 1975), the court held, *inter alia*, that DOT's impact assessment on portions of the Pan-American Highway was deficient because it failed to address the environmental impacts of alternative highway corridors through Panama and Colombia. Since the significant impacts of corridor alternatives lay exclusively in Panama and Colombia, the case necessarily holds that impacts in foreign national territory are within the scope of Section 102(2)(c).

Of course, significant indirect as well as direct impacts must be considered. 40 C.F.R. Section 1500.8(a)(3)(ii) (1975); *City of Davis v. Coleman*, 521 F. 2d 661 (9th Cir., 1975); *see* CEQ, *Environmental Quality—1974*, at 410–11 (1974).

The policies underlying NEPA reinforce the interpretation suggested by its language and legislative history, judicial precedents and administrative practice. Analysis and disclosure in an EIS of significant environmental effects provide *U.S. decisionmakers* a fuller picture of the foreseeable environmental consequences of their decisions. Impact statements do not dictate actions on foreign soil or impose U.S. requirements on foreign countries; instead, they guide U.S. decisionmakers in determining U.S. policies and actions.

In addition, EISs provide information to cooperating governments which they then could use in making decisions about projects within, or which may affect, their countries. Far from being an imposition, this information can enhance the value of U.S. assistance or participation. This full disclosure by the United States contributes to the integrity of cooperating governments' policy making, and thus lends support to international environmental cooperation as directed in § 102(2)(F),[15] the Stockholm Declaration, and other international agreements.[16]

To the extent national security or essential foreign policy considerations make controlled circulation of environmental statements necessary, NEPA provides sufficient procedural flexibility to accomplish this. Section 102(2)(C) provides exceptions to public circulation of documents by incorporating the Freedom of Information Act and its exemptions by reference. Environmental statements or portions of them have been classified, for example, when necessary to protect national security.[17] Presumably, if public examination of a proposed U.S. action in another country would jeopardize U.S. foreign policy in a given instance, circulation of the environmental statement could be restricted in accordance with these statutory procedures.[18] In general, however, Congress has mandated that environmental statements are public documents.

In summary, the Council believes that the impact statement requirement in § 102(2)(C) of NEPA applies to all significant effects of proposed federal actions on the quality of the human environment—in the United States, in other countries, and in areas outside the jurisdiction of any country. Accordingly, agency officials responsible for analyzing the potential environmental effects of proposed actions should fully assess the potential impacts outside the United States, as well as those within it; if any of these potential impacts are likely to be significant, an impact statement should be prepared.

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[14] See, e.g., Committee on Environmental Law of the Section on International and Comparative Law of the American Bar Association, Opinion on the International Scope of NEPA (July 1971); Strausberg, The National Environmental Policy Act and the Agency for International Development, 7 *Int'l Law.* 46 (1972); Robinson, Extraterritorial Environmental Protection Obligations of Foreign Affairs Agencies: The Unfulfilled Mandate of NEPA, 7 *Int'l Law. Pol.* 257 (1974); Note, The Extraterritorial Scope of NEPA's Environmental Impact Statement Requirement, 74 *Mich. L. Rev.* 349 (1975); Appelbaum, Controlling the Hazards of International Development, 5 *Ecol. L.Q.* 321 (1976).

[15] See H.R. Rep. 92-316, 92nd Cong., 1st Sess., at 33 (1971).

[16] See, e.g., Convention Concerning the Protection of the World Cultural and Natural Heritage, November 23, 1972; Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere, October 12, 1940.

[17] See, e.g., U.S. Navy, Final EIS, Transit Satellite (June 1972).

[18] Thus, NEPA incorporates a procedure for ensuring that the execution of U.S. foreign policy and U.S. environmental policy are consistent. Of course, no agency has the authority otherwise to deviate from NEPA's requirements, on foreign policy or other grounds. *Calvert Cliffs' Coordinating Comm. v. AEC*, 449 F.2d 1109 (D.C. Cir. 1971).

APPENDIX H

PREPARATION OF ENVIRONMENTAL IMPACT STATEMENTS: GUIDELINES*

On May 2, 1973, the Council on Environmental Quality published in the FEDERAL REGISTER, for public comment, a proposed revision of its guidelines for the preparation of environmental impact statements. Pursuant to the National Environmental Policy Act (P.L. 91–190, 42 U.S.C. 4321 et seq.) and Executive Order 11514 (35 FR 4247) all Federal departments, agencies, and establishments are required to prepare such statements in connection with their proposals for legislation and other major Federal actions significantly affecting the quality of the human environment. The authority for the Council's guidelines is set forth below in § 1500.1. The specific policy to be implemented by the guidelines is set forth below in § 1500.2.

The Council received numerous comments on its proposed guidelines from environmental groups, Federal, State, and local agencies, industry, and private individuals. Two general themes were presented in the majority of the comments. First, the Council should increase the opportunity for public involvement in the impact statement process. Second, the Council should provide more detailed guidance on the responsibilities of Federal agencies in light of recent court decisions interpreting the Act. The proposed guidelines have been revised in light of the specific comments relating to these general themes, as well as other comments received, and are now being issued in final form.

The guidelines will appear in the Code of Federal Regulations in Title 40, Chapter V, at Part 1500. They are being codified, in part, because they affect State and local governmental agencies, environmental groups, industry, and private individuals, in addition to Federal agencies, to which they are specifically directed, and the resultant need to make them widely and readily available.

Sec.
1500.1 Purpose and authority.
1500.2 Policy.
1500.3 Agency and OMB procedures.
1500.4 Federal agencies included: effect of the act on existing agency mandates.
1500.5 Types of actions covered by the act.
1500.6 Identifying major actions significantly affecting the environment.
1500.7 Preparing draft environmental statements; public hearings.
1500.8 Content of environmental statements.
1500.9 Review of draft environmental statements by Federal, Federal-State, State, and local agencies and by the public.
1500.10 Preparation and circulation of final environmental statements.
1500.11 Transmittal of statements to the Council; minimum periods for review; requests by the Council.

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*38 Fed. Reg. 20550–20562 (1973).

Sec.
1500.12 Legislative actions.
1500.13 Application of section 102(2)(C) procedure to existing projects and programs.
1500.14 Supplementary guidelines; evaluation of procedures.

Appendix I Summary to accompany draft and final statements.
Appendix II Areas of environmental impact and Federal agencies and Federal-State agencies with jurisdiction by law or special expertise to comment thereon.
Appendix III Offices within Federal agencies and Federal-State agencies for information regarding the agencies' NEPA activities and for receiving other agencies' impact statements for which comments are requested.
Appendix IV State and local agency review of impact statements.

AUTHORITY: National Environmental Policy Act (P.L. 91–190, 42 U.S.C. 4321 et seq.) and Executive Order 11514.

§ 1500.1 PURPOSE AND AUTHORITY

(a) This directive provides guidelines to Federal departments, agencies, and establishments for preparing detailed environmental statements on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment as required by section 102(2)(C) of the National Environmental Policy Act (P.L. 91–190, 42 U.S.C. 4321 et seq., hereafter "the Act"). Underlying the preparation of such environmental statements is the mandate of both the Act and Executive Order 11514 (35 FR 4247) of March 5, 1970, that all Federal agencies, to the fullest extent possible, direct their policies, plans and programs to protect and enhance environmental quality. Agencies are required to view their actions in a manner calculated to encourage productive and enjoyable harmony between man and his environment, to promote efforts preventing or eliminating damage to the environment and biosphere and stimulating the health and welfare of man, and to enrich the understanding of the ecological systems and natural resources important to the Nation. The objective of section 102(2)(C) of the Act and of these guidelines is to assist agencies in implementing these policies. This requires agencies to build into their decisionmaking process, beginning at the earliest possible point, an appropriate and careful consideration of the environmental aspects of proposed action in order that adverse environmental effects may be avoided or minimized and environmental quality previously lost may be restored. This directive also provides guidance to Federal, State, and local agencies and the public in commenting on statements prepared under these guidelines.

(b) Pursuant to section 204(3) of the Act the Council on Environmental Quality (hereafter "the Council") is assigned the duty and function of reviewing and appraising the programs and activities of the Federal Government, in the light of the Act's policy, for the purpose of determining the extent to which such programs and activities are contributing to the achievement of such policy, and to make recommendations to the President with respect thereto. Section 102(2)(B) of the Act directs all Federal agencies to identify and develop methods and procedures, in consultation with the Council, to insure that unquantified environmental values be given appropriate consideration in decisionmaking along with economic and technical considerations; section 102(2)(C) of the Act directs that copies of all environmental impact statements be filed with the Council; and section 102(2)(H) directs all Federal agencies to assist the Council in the performance of its functions. These provisions have been supplemented in sections 3 (h) and (i) of Executive Order 11514 by direction that the Council issue guidelines to Federal agencies for preparation of environmental impact statements and such other instructions to agencies and requests for reports and information as may be required to carry out the Council's responsibilities under the Act.

§ 1500.2 POLICY

(a) As early as possible and in all cases prior to agency decision concerning recommendations or favorable reports on proposals for (1) legislation significantly affecting the quality of the human environment (see §§ 1500.5(i) and 1500.12) (hereafter "legislative actions") and (2) all other major Federal actions significantly affecting the quality of the human environment (hereafter "administrative actions"), Federal agencies will, in consultation with other appropriate Federal, State and local agencies and the public assess in detail the potential environmental impact.

(b) Initial assessments of the environmental impacts of proposed action should be undertaken concurrently with initial technical and economic studies and, where required, a draft environmental impact statement prepared and circulated for comment in time to accompany the proposal through the existing agency review processes for such action. In this process, Federal agencies shall: (1) Provide for circulation of draft environmental statements to other Federal, State, and local agencies and for their availability to the public in accordance with the provisions of these guidelines; (2) consider the comments of the agencies and the public; and (3) issue final environmental impact statements responsive to the comments received. The purpose of this assessment and consultation process is to provide agencies and other decisionmakers as well as members of the public with an understanding of the potential environmental effects of proposed actions, to avoid or minimize adverse effects wherever possible, and to restore or enhance environmental quality to the fullest extent practicable. In particular, agencies should use the environmental impact statement process to explore alternative actions that will avoid or minimize adverse impacts and to evaluate both the long- and short-range implications of proposed actions to man, his physical and social surroundings, and to nature. Agencies should consider the results of their environmental assessments along with their assessments of the net economic, technical and other benefits of proposed actions and use all practicable means, consistent with other essential considerations of national policy, to restore environmental quality as well as to avoid or minimize undesirable consequences for the environment.

§ 1500.3 AGENCY AND OMB PROCEDURES

(a) Pursuant to section 2(f) of Executive Order 11514, the heads of Federal agencies have been directed to proceed with measures required by section 102(2)(C) of the Act. Previous guidelines of the Council directed each agency to establish its own formal procedures for (1) identifying those agency actions requiring environmental statements, the appropriate time prior to decision for the consultations required by section 102(2)(C) and the agency review process for which environmental statements are to be available, (2) obtaining information required in their preparation, (3) designating the officials who are to be responsible for the statements, (4) consulting with and taking account of the comments of appropriate Federal, State and local agencies and the public, including obtaining the comment of the Administrator of the Environmental Protection Agency when required under section 309 of the Clean Air Act, as amended, and (5) meeting the requirements of section 2(b) of Executive Order 11514 for providing timely public information on Federal plans and programs with environmental impact. Each agency, including both departmental and subdepartmental components having such procedures, shall review its procedures and shall revise them, in consultation with the Council, as may be necessary in order to respond to requirements imposed by these revised guidelines as well as by such previous directions. After such consultation, proposed revisions of such agency procedures shall be published in the FEDERAL REGISTER no later than October 30, 1973. A minimum 45-day period for public comment shall be provided, followed by publication of final procedures no later than forty-five (45 days) after the conclusion of the comment period. Each agency shall submit seven (7) copies of all such procedures to the Council. Any future revision of such agency procedures shall similarly be proposed and adopted only after prior consultation with the Council and, in the case of substantial revision, opportunity for public comment. All revisions shall be published in the FEDERAL REGISTER.

(b) Each Federal agency should consult, with the assistance of the Council and the Office of Management and Budget if desired, with other appropriate Federal agencies in the development and revision of the above procedures so as to achieve consistency in dealing with similar activities and to assure effective coordination among agencies in their review of proposed activities. Where applicable State and local review of such agency procedures should be conducted pursuant to procedures established by Office of Management and Budget Circular No. A–85.

(c) Existing mechanisms for obtaining the views of Federal, State, and local agencies on proposed Federal actions should be utilized to the maximum extent practicable in dealing with environmental matters. The Office of Management and Budget will issue instructions, as necessary, to take full advantage of such existing mechanisms.

§ 1500.4 FEDERAL AGENCIES INCLUDED; EFFECT OF THE ACT ON EXISTING AGENCY MANDATES

(a) Section 102(2)(C) of the Act applies to all agencies of the Federal Government. Section 102 of the Act provides that "to the fullest extent possible: (1) The policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in this Act," and section 105 of the Act provides that "the policies and goals set forth in this Act are supplementary to those set forth in existing authorizations of Federal agencies." This means that each agency shall interpret the provisions of the Act as a supplement to its existing authority and as a mandate to view traditional policies and missions in the light of the Act's national environmental objectives. In accordance with this purpose, agencies should continue to review their policies, procedures, and regulations and to revise them as necessary to ensure full compliance with the purposes and provisions of the Act. The phrase "to the fullest extent possible" in section 102 is meant to make clear that each agency of the Federal Government shall comply with that section unless existing law applicable to the agency's operations expressly prohibits or makes compliance impossible.

§ 1500.5 TYPES OF ACTIONS COVERED BY THE ACT

(a) "Actions" include but are not limited to:

(1) Recommendations or favorable reports relating to legislation including requests for appropriations. The requirement for following the section 102 (2)(C) procedure as elaborated in these guidelines applies to both (i) agency recommendations on their own proposals for legislation (see § 1500.12); and (ii) agency reports on legislation initiated elsewhere. In the latter case only the agency which has primary responsibility for the subject matter involved will prepare an environmental statement.

(2) New and continuing projects and program activities: directly undertaken by Federal agencies; or supported in whole or in part through Federal contracts, grants, subsidies, loans, or other forms of funding assistance (except where such assistance is solely in the form of general revenue sharing funds, distributed under the State and Local Fiscal Assistance Act of 1972, 31 U.S.C. 1221 et seq. with no Federal agency control over the subsequent use of such funds); or involving a Federal lease, permit, license certificate or other entitlement for use.

(3) The making, modification, or establishment of regulations, rules, procedures, and policy.

§ 1500.6 IDENTIFYING MAJOR ACTIONS SIGNIFICANTLY AFFECTING THE ENVIRONMENT

(a) The statutory clause "major Federal actions significantly affecting the quality of the human environment" is to be construed by agencies with a view to the overall, cumulative impact of the action proposed, related Federal actions and projects in the area, and further actions contemplated. Such actions may be localized in their impact, but if there is potential that the environment may be significantly affected, the statement is to be prepared. Proposed major actions, the environmental impact of which is likely to be highly controversial, should be covered in all cases. In considering what constitutes major action significantly affecting the environment, agencies should bear in mind that the effect of many Federal decisions about a project or complex of projects can be individually limited but cumulatively considerable. This can occur when one or more agencies over a period of years puts into a project individually minor but collectively major resources, when one decision involving a limited amount of money is a precedent for action in much larger cases or represents a decision in principle about a future major course of action, or when several Government agencies individually make decisions about partial aspects of a major action. In all such cases, an environmental statement should be prepared if it is reasonable to anticipate a cumulatively significant impact on the environment from Federal action. The Council, on the basis of a written assessment of the impacts involved, is available to assist agencies in determining whether specific actions require impact statements.

(b) Section 101(b) of the Act indicates the broad range of aspects of the environment to be surveyed in any assessment of significant effect. The Act also indicates that adverse significant effects include those that degrade the quality of the environment, curtail the range of beneficial uses of the environment, and serve short-term, to the disadvantage of long-term, environmental goals. Significant effects can also include actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial. Significant effects also include secondary effects, as described more fully, for example, in § 1500.8(a)(iii)(B). The significance of a proposed action may also vary with the setting, with the result that an action that would have little impact in an urban area may be significant in a rural setting or vice versa. While a precise definition of environmental "significance," valid in all contexts, is not possible, effects to be considered in assessing significance include, but are not limited to, those outlined in Appendix II of these guidelines.

(c) Each of the provisions of the Act, except section 102(2)(C), applies to all Federal agency actions. Section 102(2)(C) requires the preparation of a detailed environmental impact statement in the case of "major Federal actions significantly affecting the quality of the human environment." The identification of major actions significantly affecting the environment is the responsibility of each Federal agency, to be carried out against the background of its own particular operations. The action must be a (1) "major" action, (2) which is a "Federal action," (3) which has a "significant" effect, and (4) which involves the "quality of the human environment." The words "major" and "significantly" are intended to imply thresholds of importance and impact that must be met before a statement is required. The action causing the impact must also be one where there is sufficient Federal control and responsibility to constitute "Federal action" in contrast to cases where such Federal control and responsibility are not present as, for example, when Federal funds are distributed in the form of general revenue sharing to be used by State and local governments (see § 1500.5a(ii)). Finally, the action must be one that significantly affects the quality of the human environment either by directly affecting human beings or by indirectly affecting human beings through adverse effects on the environment. Each agency should review the typical classes of actions that it undertakes and, in consultation with the Council, should develop specific criteria and methods for identifying those actions likely to require environmental statements and those actions likely not to require environmental statements. Normally this will involve:

(i) Making an initial assessment of the environmental impacts typically associated with principal types of agency action.

(ii) Identifying on the basis of this assessment, types of actions which normally do, and types of actions which normally do not, require statements.

(iii) With respect to remaining actions that may require statements depending on the circumstances, and those actions determined under the preceding paragraph (ii) of this section as likely to require statements, identifying: (*a*) what basic information needs to be gathered; (*b*) how and when such information is to be assembled and analyzed; and (*c*) on what bases environmental assessments and decisions to prepare impact statements will be made. Agencies may either include this substantive guidance in the procedures issued pursuant to § 1500.3(a) of these guidelines, or issue such guidance as supplemental instructions to aid relevant agency personnel in implementing the impact statement process. Pursuant to § 1500.14 of these guidelines, agencies shall report to the Council by June 30, 1974, on the progress made in developing such substantive guidance.

(d)(1) Agencies should give careful attention to identifying and defining the purpose and scope of the action which would most appropriately serve as the subject of the statement. In many cases, broad program statements will be required in order to assess the environmental effects of a number of individual actions on a given geographical area (e.g., coal leases), or environmental impacts that are generic or common to a series of agency actions (e.g., maintenance or waste handling practices), or the overall impact of a large-scale program or chain of contemplated projects (e.g., major lengths of highway as opposed to small segments). Subsequent statements on major individual actions will be necessary where such actions have significant environmental impacts not adequately evaluated in the program statement.

(2) Agencies engaging in major technology research and development programs should develop procedures for periodic evaluation to determine when a program statement is required for such programs. Factors to be considered in making this determination include the magnitude of Federal investment in the program, the likelihood of widespread application of the technology, the degree of environmental impact which would occur if the technology were widely applied, and the extent to which continued investment in the new technology is likely to restrict future alternatives. Statements must be written late enough in the development process to contain meaningful information, but early enough so that this information can practically serve as an input in the decision-making process. Where it is anticipated that a statement may ultimately be required but that its preparation is still premature, the agency should prepare an evaluation briefly setting forth the reasons for its determi-

nation that a statement is not yet necessary. This evaluation should be periodically updated, particularly when significant new information becomes available concerning the potential environmental impact of the program. In any case, a statement must be prepared before research activities have reached a stage of investment or commitment to implementation likely to determine subsequent development or restrict later alternatives. Statements on technology research and development programs should include an analysis not only of alternative forms of the same technology that might reduce any adverse environmental impacts but also of alternative technologies that would serve the same function as the technology under consideration. Efforts should be made to involve other Federal agencies and interested groups with relevant expertise in the preparation of such statements because the impacts and alternatives to be considered are likely to be less well defined than in other types of statements.

(e) In accordance with the policy of the Act and Executive Order 11514 agencies have a responsibility to develop procedures to insure the fullest practicable provision of timely public information and understanding of Federal plans and programs with environmental impact in order to obtain the views of interested parties. In furtherance of this policy, agency procedures should include an appropriate early notice system for informing the public of the decision to prepare a draft environmental statement on proposed administrative actions (and for soliciting comments that may be helpful in preparing the statement) as soon as is practicable after the decision to prepare the statement is made. In this connection, agencies should: (1) maintain a list of administrative actions for which environmental statements are being prepared; (2) revise the list at regular intervals specified in the agency's procedures developed pursuant to § 1500.3(a) of these guidelines (but not less than quarterly) and transmit each such revision to the Council; and (3) make the list available for public inspection on request. The Council will periodically publish such lists in the FEDERAL REGISTER. If an agency decides that an environmental statement is not necessary for a proposed action (i) which the agency has identified pursuant to § 1500.6(c)(ii) as normally requiring preparation of a statement, (ii) which is similar to actions for which the agency has prepared a significant number of statements, (iii) which the agency has previously announced would be the subject of a statement, or (iv) for which the agency has made a negative determination in response to a request from the Council pursuant to § 1500.11(f), the agency shall prepare a publicly available record briefly setting forth the agency's decision and the reasons for that determination. Lists of such negative determinations, and any evaluations made pursuant to § 1500.6 which conclude that preparation of a statement is not yet timely, shall be prepared and made available in the same manner as provided in this subsection for lists of statements under preparation.

§ 1500.7 PREPARING DRAFT ENVIRONMENTAL STATEMENTS; PUBLIC HEARINGS

(a) Each environmental impact statement shall be prepared and circulated in draft form for comment in accordance with the provisions of these guidelines. The draft statement must fulfill and satisfy to the fullest extent possible at the time the draft is prepared the requirements established for final statements by section 102(2)(C). (Where an agency has an established practice of declining to favor an alternative until public comments on a proposed action have been received, the draft environmental statement may indicate that two or more alternatives are under consideration.) Comments received shall be carefully evaluated and considered in the decision process. A final statement with substantive comments attached shall then be issued and circulated in accordance with applicable provisions of §§ 1500.10, 1500.11, or 1500.12. It is important that draft environmental statements be prepared and circulated for comment and furnished to the Council as early as possible in the agency review process in order to permit agency decisionmakers and outside reviewers to give meaningful consideration to the environmental issues involved. In particular, agencies should keep in mind that such statements are to serve as the means of assessing the environmental impact of proposed agency actions, rather than as a justification for decisions already made. This means that draft statements on administrative actions should be prepared and circulated for comment prior to the first significant point of decision in the agency review process. For major categories of agency action, this point should be identified in the procedures issued pursuant to § 1500.3(a). For major categories of projects involving an applicant and identified pursuant to § 1500.6(c)(ii) as normally requiring the preparation of a statement, agencies should include in their procedures provisions limiting actions which an applicant is permitted to take prior to completion and review of the final statement with respect to his application.

(b) Where more than one agency (1) directly sponsors an action, or is directly involved in an action through funding, licenses, or permits, or (2) is involved in a group of actions directly related to each other because of their functional interdependence and geographical proximity, consideration should be given to preparing one statement for all the Federal actions involved (see § 1500.6(d)(1)). Agencies in such cases should consider the possibility of joint preparation of a statement by all agencies concerned, or designation of a single "lead agency" to assume supervisory responsibility for preparation of the statement. Where a lead agency prepares the statement, the other agencies involved should provide assistance with respect to their areas of jurisdiction and expertise. In either case, the statement should contain an environmental assessment of the full range of Federal actions involved, should reflect the views of all participating agencies, and should be prepared before major or irreversible actions have been taken by any of the participating agencies. Factors relevant in determining an appropriate lead agency include the time sequence in which the agencies become involved, the magnitude of their respective involvement, and their relative expertise with respect to the project's environmental effects. As necessary, the Council will assist in resolving questions of responsibility for statement preparation in the case of multi-agency actions. Federal Regional Councils, agencies and the public are encouraged to bring to the attention of the Council and other relevant agencies appropriate situations where a geographic or regionally focused statement would be desirable because of the cumulative environmental effects likely to result from multi-agency actions in the area.

(c) Where an agency relies on an applicant to submit initial environmental information, the agency should assist the applicant by outlining the types of information required. In all cases, the agency should make its own evaluation of the environmental issues and take responsibility for the scope and content of draft and final environmental statements.

(d) Agency procedures developed pursuant to § 1500.3(a) of these guidelines should indicate as explicitly as possible those types of agency decisions or actions which utilize hearings as part of the normal agency review process, either as a result of statutory requirement or agency practice. To the fullest extent possible, all such hearings shall include consideration of the environmental aspects of the proposed action. Agency procedures shall also specifically include provision for public hearings on major actions with environmental impact, whenever appropriate, and for providing the public with relevant information, including information on alternative courses of action. In deciding whether a public hearing is appropriate, an agency should consider: (1) the magnitude of the proposal in terms of economic costs, the geographic area involved, and the uniqueness or size of commitment of the resources involved; (2) the degree of interest in the proposal, as evidenced by requests from the public and from Federal, State and local authorities that a hearing be held; (3) the complexity of the issue and the likelihood that information will be presented at the hearing which will be of assistance to the agency in fulfilling its responsibilities under the Act; and (4) the extent to which public involvement already has been achieved through other means, such as earlier public hearings, meetings with citizen representatives, and/or written comments on the proposed action. Agencies should make any draft environmental statements to be issued available to the public at least fifteen (15) days prior to the time of such hearings.

§ 1500.8 CONTENT OF ENVIRONMENTAL STATEMENTS

(a) The following points are to be covered:

(1) A description of the proposed action, a statement of its purposes, and a description of the environment affected, including information, summary technical data, and maps and diagrams where relevant, adequate to permit an assessment of potential environmental impact by commenting agencies and the public. Highly technical and specialized analyses and data should be avoided in the body of the draft impact statement. Such materials should be attached as appendices or footnoted with adequate bibliographic references. The statement should also succinctly describe the environment of the area affected as it exists prior to a proposed action, including other Federal activities in the area affected by the proposed action which are related to the proposed action. The interrelationships and cumulative environmental impacts of the proposed action and other related Federal projects shall be presented in the statement. The amount of detail provided in such descriptions should be commensurate with the extent and expected impact of the action, and with the amount of information required at the particular level of decisionmaking (planning, feasibility, design, etc.). In order to ensure accurate descriptions and environmental assessments, site visits should be made where feasible. Agencies should also take care to identify, as appropriate, population and growth characteristics of the affected area and any population and growth assumptions used to justify the project or program or to determine secondary population and growth impacts resulting from the proposed action and its alternatives (see paragraph (3)(ii), of this section). In discussing these population aspects, agencies should give consideration to using the rates of growth in the region of the project contained in the projection compiled for the Water Resources Council by the Bureau of Economic Analysis of the Department of Commerce and the Economic Research Service of the Department of Agriculture (the "OBERS" projection). In any event it is essential that the sources of data used to identify, quantify or evaluate any and all environmental consequences be expressly noted.

(2) The relationship of the proposed action to land use plans, policies, and controls for the affected area. This requires a discussion of how the proposed action may conform or conflict with the objectives and specific terms of approved or proposed Federal, State, and local land use plans, policies and controls, if any, for the area affected, including those developed in response to the Clean Air Act or the Federal Water Pollution Control Act Amendments of 1972. Where a conflict or inconsistency exists, the statement should describe the extent to which the agency has reconciled its proposed action with the plan, policy or control and the reasons why the agency has decided to proceed notwithstanding the absence of full reconciliation.

(3) The probable impact of the proposed action on the environment.

(i) This requires agencies to assess the positive and negative effects of the proposed action as it affects both the national and international environment. The attention given to different environmental factors will vary according to the nature, scale, and location of proposed actions. Among factors to consider should be the potential effect of the action on such aspects of the environment as those listed in Appendix II of these guidelines. Primary attention

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should be given in the statement to discussing those factors most evidently impacted by the proposed action.

(ii) Secondary or indirect, as well as primary or direct, consequences for the environment should be included in the analysis. Many major Federal actions, in particular those that involve the construction or licensing of infrastructure investments (e.g., highways, airports, sewer systems, water resource projects, etc.), stimulate or induce secondary effects in the form of associated investments and changed patterns of social and economic activities. Such secondary effects, through their impacts on existing community facilities and activities, through inducing new facilities and activities, or through changes in natural conditions, may often be even more substantial than the primary effects of the original action itself. For example, the effects of the proposed action on population and growth may be among the more significant secondary effects. Such population and growth impacts should be estimated if expected to be significant (using data identified as indicated in § 1500.8(a)(1)) and an assessment made of the effect of any possible change in population patterns or growth upon the resource base, including land use, water, and public services, of the area in question.

(4) Alternatives to the proposed action, including, where relevant, those not within the existing authority of the responsible agency. (Section 102(2)(D) of the Act requires the responsible agency to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources"). A rigorous exploration and objective evaluation of the environmental impacts of all reasonable alternative actions, particularly those that might enhance environmental quality or avoid some or all of the adverse environmental effects, is essential. Sufficient analysis of such alternatives and their environmental benefits, costs and risks should accompany the proposed action through the agency review process in order not to foreclose prematurely options which might enhance environmental quality or have less detrimental effects. Examples of such alternatives include: the alternative of taking no action or of postponing action pending further study; alternatives requiring actions of a significantly different nature which would provide similar benefits with different environmental impacts (e.g., nonstructural alternatives to flood control programs, or mass transit alternatives to highway construction); alternatives related to different designs or details of the proposed action which would present different environmental impacts (e.g., cooling ponds vs. cooling towers for a power plant or alternatives that will significantly conserve energy); alternative measures to provide for compensation of fish and wildlife losses, including the acquisition of land, waters, and interests therein. In each case, the analysis should be sufficiently detailed to reveal the agency's comparative evaluation of the environmental benefits, costs and risks of the proposed action and each reasonable alternative. Where an existing impact statement already contains such an analysis, its treatment of alternatives may be incorporated provided that such treatment is current and relevant to the precise purpose of the proposed action.

(5) Any probable adverse environmental effects which cannot be avoided (such as water or air pollution, undesirable land use patterns, damage to life systems, urban congestion, threats to health or other consequences adverse to the environmental goals set out in section 101(b) of the Act). This should be a brief section summarizing in one place those effects discussed in paragraph (a)(3) of this section that are adverse and unavoidable under the proposed action. Included for purposes of contrast should be a clear statement of how other avoidable adverse effects discussed in paragraph (a)(2) of this section will be mitigated.

(6) The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity. This section should contain a brief discussion of the extent to which the proposed action involves tradeoffs between short-term environmental gains at the expense

of long-term losses, or vice versa, and a discussion of the extent to which the proposed action forecloses future options. In this context short-term and long-term do not refer to any fixed time periods, but should be viewed in terms of the environmentally significant consequences of the proposed action.

(7) Any irreversible and irretrievable commitments of resources that would be involved in the proposed action should it be implemented. This requires the agency to identify from its survey unavoidable impacts in paragraph (a)(5) of this section the extent to which the action irreversibly curtails the range of potential uses of the environment. Agencies should avoid construing the term "resources" to mean only the labor and materials devoted to an action. "Resources" also means the natural and cultural resources committed to loss or destruction by the action.

(8) An indication of what other interests and considerations of Federal policy are thought to offset the adverse environmental effects of the proposed action identified pursuant to paragraphs (a)(3) and (5) of this section. The statement should also indicate the extent to which these stated countervailing benefits could be realized by following reasonable alternatives to the proposed action (as identified in paragraph (a)(4) of this section) that would avoid some or all of the adverse environmental effects. In this connection, agencies that prepare cost-benefit analyses of proposed actions should attach such analyses, or summaries thereof, to the environmental impact statement, and should clearly indicate the extent to which environmental costs have not been reflected in such analyses.

(b) In developing the above points agencies should make every effort to convey the required information succinctly in a form easily understood, both by members of the public and by public decisionmakers, giving attention to the substance of the information conveyed rather than to the particular form, or length, or detail of the statement. Each of the above points, for example, need not always occupy a distinct section of the statement if it is otherwise adequately covered in discussing the impact of the proposed action and its alternatives—which items should normally be the focus of the statement. Draft statements should indicate at appropriate points in the text any underlying studies, reports, and other information obtained and considered by the agency in preparing the statement including any cost-benefit analyses prepared by the agency, and reports of consulting agencies under the Fish and Wildlife Coordination Act, 16 U.S.C. 661 et seq., and the National Historic Preservation Act of 1966, 16 U.S.C. 470 et seq., where such consultation has taken place. In the case of documents not likely to be easily accessible (such as internal studies or reports), the agency should indicate how such information may be obtained. If such information is attached to the statement, care should be taken to ensure that the statement remains an essentially self-contained instrument, capable of being understood by the reader without the need for undue cross reference.

(c) Each environmental statement should be prepared in accordance with the precept in section 102(2)(A) of the Act that all agencies of the Federal Government "utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and decisionmaking which may have a impact on man's environment." Agencies should attempt to have relevant disciplines represented on their own staffs; where this is not feasible they should make appropriate use of relevant Federal, State, and local agencies or the professional services of universities and outside consultants. The interdisciplinary approach should not be limited to the preparation of the environmental impact statement, but should also be used in the early planning stages of the proposed action. Early application of such an approach should help assure a systematic evaluation of reasonable alternative courses of action and their potential social, economic, and environmental consequences.

(d) Appendix I prescribes the form of the summary sheet which should accompany each draft and final environmental statement.

§ 1500.9 REVIEW OF DRAFT ENVIRONMENTAL STATEMENTS BY FEDERAL, FEDERAL–STATE, STATE, AND LOCAL AGENCIES AND BY THE PUBLIC

(a) *Federal agency review: In general.* A Federal agency considering an action requiring an environmental statement should consult with, and (on the basis of a draft environmental statement for which the agency takes responsibility) obtain the comment on the environmental impact of the action of Federal and Federal-State agencies with jurisdiction by law or special expertise with respect to any environmental impact involved. These Federal and Federal-State agencies and their relevant areas of expertise include those identified in Appendices II and III to these guidelines. It is recommended that the listed departments and agencies establish contact points, which may be regional offices, for providing comments on the environmental statements. The requirement in section 102(2)(C) to obtain comment from Federal agencies having jurisdiction or special expertise is in addition to any specific statutory obligation of any Federal agency to coordinate or consult with any other Federal or State agency. Agencies should, for example, be alert to consultation requirements of the Fish and Wildlife Coordination Act, 16 U.S.C. 661 et seq., and the National Historic Preservation Act of 1966, 16 U.S.C. 470 et seq. To the extent possible, statements or findings concerning environmental impact required by other statutes, such as section 4(f) of the Department of Transportation Act of 1966, 49 U.S.C. 1653(f), or section 106 of the National Historic Preservation Act of 1966, should be combined with compliance with the environmental impact statement requirements of section 102(2)(C) of the Act to yield a single document which meets all applicable requirements. The Advisory Council on Historic Preservation, the Department of Transportation, and the Department of Interior, in consultation with the Council, will issue any necessary supplementing instructions for furnishing information or findings not forthcoming under the environmental impact statement process.

(b) *EPA review:* Section 309 of the Clean Air Act, as amended (42 U.S.C. § 1857h–7), provides that the Administrator of the Environmental Protection Agency shall comment in writing on the environmental impact of any matter relating to his duties and responsibilities, and shall refer to the Council any matter that the Administrator determines is unsatisfactory from the standpoint of public health or welfare or environmental quality. Accordingly, wherever an agency action related to air or water quality, noise abatement and control, pesticide regulation, solid waste disposal, generally applicable environmental radiation criteria and standards, or other provision of the authority of the Administrator involved, Federal agencies are required to submit such proposed actions and their environmental impact statements, if such have been prepared, to the Administrator for review and comment in writing. In all cases where EPA determines that proposed agency action is environmentally unsatisfactory, or where EPA determines that an environmental statement is so inadequate that such a determination cannot be made, EPA shall publish its determination and notify the Council as soon as practicable. The Administrator's comments shall constitute his comments for the purposes of both section 309 of the Clean Air Act and section 102(2)(C) of the National Environmental Policy Act.

(c) *State and local review:* Office of Management and Budget Circular No. A–95 (Revised) through its system of State and areawide clearinghouses provides a means for securing the views of State and local environmental agencies, which can assist in the preparation and review of environmental impact statements. Current instructions for obtaining the views of such agencies are contained in the joint OMB–CEQ memorandum attached to these guidelines as Appendix IV. A current listing of clearinghouses is issued periodically by the Office of Management and Budget.

(d) *Public review:* The procedures established by these guidelines are designed to encourage public participation in the impact statement process at the earliest possible time. Agency procedures should make provision for facilitating the comment of public and private organizations and indviduals by announcing the availability of draft environmental statements and by making copies available to organizations and individuals that request an opportunity to comment. Agencies should devise methods for publicizing the existence of draft statements, for example, by publication of notices in local newspapers or by maintaining a list of groups, including relevant conservation commissions, known to be interested in the agency's activities and directly notifying such groups of the existence of a draft statement, or sending them a copy, as soon as it has been prepared. A copy of the draft statement should in all cases be sent to any applicant whose project is the subject of the statement. Materials to be made available to the public shall be provided without charge to the extent practicable, or at a fee which is not more than the actual cost of reproducing copies required to be sent to other Federal agencies, including the Council.

(e) *Responsibilities of commenting entities:* (1) Agencies and members of the public submitting comments on proposed actions on the basis of draft environmental statements should endeavor to make their comments as specific, substantive, and factual as possible without undue attention to matters of form in the impact statement. Although the comments need not conform to any particular format, it would assist agencies reviewing comments if the comments were organized in a manner consistent with the structure of the draft statement. Emphasis should be placed on the assessment of the environmental impacts of the proposed action, and the acceptability of those impacts on the quality of the environment, particularly as contrasted with the impacts of reasonable alternatives to the action. Commenting entities may recommend modifications to the proposed action and/or new alternatives that will enhance environmental quality and avoid or minimize adverse environmental impacts.

(2) Commenting agencies should indicate whether any of their projects not identified in the draft statement are sufficiently advanced in planning and related environmentally to the proposed action so that a discussion of the environmental interrelationships should be included in the final statement (see § 1500.8(a)(1)). The Council is available to assist agencies in making such determinations.

(3) Agencies and members of the public should indicate in their comments the nature of any monitoring of the environmental effects of the proposed project that appears particularly appropriate. Such monitoring may be necessary during the construction, startup, or operation phases of the project. Agencies with special expertise with respect to the environmental impacts involved are encouraged to assist the sponsoring agency in the establishment and operation of appropriate environmental monitoring.

(f) Agencies seeking comment shall establish time limits of not less than forty-five (45) days for reply, after which it may be presumed, unless the agency or party consulted requests a specified extension of time, that the agency or party consulted has no comment to make. Agencies seeking comment should endeavor to comply with requests for extensions of time of up to fifteen (15) days. In determining an appropriate period for comment, agencies should consider the magnitude and complexity of the statement and the extent of citizen interest in the proposed action.

§ 1500.10 PREPARATION AND CIRCULATION OF FINAL ENVIRONMENTAL STATEMENTS

(a) Agencies should make every effort to discover and discuss all major points of view on the environmental effects of the proposed action and its alternatives in the draft statement itself. However, where opposing professional views and responsible opinion have been overlooked in the draft statement and are brought to the agency's attention through the commenting process, the agency should review the environmental effects of the action in light of those views and should make a meaningful reference in the final statement to the existence of any responsible opposing view not adequately discussed in the draft statement, indicating the agency's response to the issues raised. All substantive comments received on the draft (or summaries thereof where response has been exceptionally voluminous) should be attached to the final statement, whether or not each such comment is thought to merit individual discussion by the agency in the text of the statement.

(b) Copies of final statements, with comments attached, shall be sent to all Federal, State, and local agencies and private organizations that made substantive comments on the draft statement and to individuals who requested a copy of the final statement, as well as any applicant whose project is the subject of the statement. Copies of final statements shall in all cases be sent to the Environmental Protection Agency to assist it in carrying out its responsibilities under section 309 of the Clean Air Act. Where the number of comments on a draft statement is such that distribution of the final statement to all commenting entities appears impracticable, the agency shall consult with the Council concerning alternative arrangements for distribution of the statement.

§ 1500.11 TRANSMITTAL OF STATEMENTS TO THE COUNCIL; MINIMUM PERIODS FOR REVIEW; REQUESTS BY THE COUNCIL

(a) As soon as they have been prepared, ten (10) copies of draft environmental statements, five (5) copies of all comments made thereon (to be forwarded to the Council by the entity making comment at the time comment is forwarded to the responsible agency), and ten (10) copies of the final text of environmental statements (together with the substance of all comments received by the responsible agency from Federal, State, and local agencies and from private organizations and individuals) shall be supplied to the Council. This will serve to meet the statutory requirement to make environmental statements available to the President. At the same time that copies of draft and final statements are sent to the Council, copies should also be sent to relevant commenting entities as set forth in §§ 1500.9 and 1500.10(b) of these guidelines.

(b) To the maximum extent practicable no administrative action subject to section 102(2)(C) is to be taken sooner than ninety (90) days after a draft environmental statement has been circulated for comment, furnished to the Council and, except where advance public disclosure will result in significantly increased costs of procurement to the Government, made available to the public pursuant to these guidelines; neither should such administrative action be taken sooner than thirty (30) days after the final text of an environmental statement (together with comments) has been made available to the Council, commenting agencies, and the public. In all cases, agencies should allot a sufficient review period for the final statement so as to comply with the statutory requirement that the "statement and the comments and views of appropriate Federal, State, and local agencies * * * accompany the proposal through the existing agency review processes." If the final text of an environmental statement is filed within ninety (90) days after a draft statement has been circulated for comment, furnished to the Council and made public pursuant to this section of these guidelines, the minimum thirty (30) day period and the ninety (90) day period may run concurrently to the extent that they overlap. An agency may at any time supplement or amend a draft or final environmental statement, particularly when substantial changes are made in the proposed action, or significant new information becomes available concerning its environmental aspects. In such cases the agency should consult with the Council with respect to the possible need or desirability of recirculation of the statement for the appropriate period.

(c) The Council will publish weekly in the FEDERAL REGISTER lists of environmental statements received during the preceding week that are available for public comment. The date of publication of such lists shall be the date from which the minimum periods for review and advance availability of statements shall be calculated.

(d) The Council's publication of notice of the availability of statements is in addition to the agency's responsibility, as described in § 1500.9(d) of these guidelines, to insure the fullest practicable provision of timely public information concerning the existence and availability of environmental statements. The agency responsible for the environmental statement is also responsible for making the statement, the comments received, and any underlying documents available to the public pursuant to the provisions of the Freedom of Information Act (5 U.S.C. 552), without regard to the exclusion of intra- or interagency memoranda when such memoranda transmit comments of Federal agencies on the environmental impact of the proposed action pursuant to § 1500.9 of these guidelines. Agency procedures prepared pursuant to § 1500.3 (a) of these guidelines shall implement these public information requirements and shall include arrangements for availability of environmental statements and comments at the head and appropriate regional offices of the responsible agency and at appropriate State and areawide clearinghouses unless the Governor of the State involved designates to the Council some other point for receipt of this information. Notice of such designation of an alternate point for receipt of this information will be included in the Office of Management and Budget listing of clearinghouses referred to in § 1500.9(c).

(e) Where emergency circumstances make it necessary to take an action with significant environmental impact without observing the provisions of these guidelines concerning minimum periods for agency review and advance availability of environmental statements, the Federal agency proposing to take the action should consult with the Council about alternative arrangements. Similarly where there are overriding considerations of expense to the Government or impaired program effectiveness, the responsible agency should consult with the Council concerning appropriate modifications of the minimum periods.

(f) In order to assist the Council in fulfilling its responsibilities under the Act and under Executive Order 11514, all agencies shall (as required by section 102(2)(H) of the Act and section 3(i) of Executive Order 11514) be resposive to requests by the council for reports and other information dealing with issues arising in connection with the implementaton of the Act. In particular, agencies shall be responsive to a request by the Council for the preparation and circulation of an environmental statement, unless the agency determines that such a statement is not required, in which case the agency shall prepare an environmental assessment and a publicly available record briefly setting forth the reasons for its determination. In no case, however, shall the Council's silence or failure to comment or request preparation, modification, or recirculation of an environmental statement or to take other action with respect to an environmental statement be construed as bearing in any way on the question of the legal requirement for or the adequacy of such statement under the Act.

§ 1500.12 LEGISLATIVE ACTIONS

(a) The Council and the Office of Management and Budget will cooperate in giving guidance as needed to assist agencies in identifying legislative items believed to have environmental significance. Agencies should prepare impact statements prior to submission of their legislative proposals to the Office of Management and Budget. In this regard, agencies should identify types of repetitive legislation requiring environmental impact statements (such as certain types of bills affecting transportation policy or annual construction authorizations).

(b) With respect to recommendations or reports on proposals for legislation to which section 102(2)(C) applies, the final text of the environmental statement and comments thereon should be available to the Congress and to the public for consideration in connection with the proposed legislation or report. In cases where the scheduling of congressional hearings on recommendations or reports on proposals for legislation which the Federal agency has forwarded to the Congress does not allow adequate time for the completion of a final text of an environmental statement (together with comments), a draft environmental statement may be furnished to the Congress and made available to the public pending transmittal of the comments as received and the final text.

§ 1500.13 APPLICATION OF SECTION 102(2)(C) PROCEDURE TO EXISTING PROJECTS AND PROGRAMS

Agencies have an obligation to reassess ongoing projects and programs in order to avoid or minimize adverse environmental effects. The section 102(2)(C) procedure shall be applied to further major Federal actions having a significant effect on the environment even though they arise from projects or programs initiated prior to enactment of the Act on January 1, 1970. While the status of the work and degree of completion may be considered in determining whether to proceed with the project, it is essential that the environmental impacts of proceeding are reassessed pursuant to the Act's policies and procedures and, if the project or program is continued, that further incremental major actions be shaped so as to enhance and restore environmental quality as well as to avoid or minimize adverse environmental consequences. It is also important in further action that account be taken of environmental consequences not fully evaluated at the outset of the project or program.

§ 1500.14 SUPPLEMENTARY GUIDELINES; EVALUATION OF PROCEDURES

(a) The Council after examining environmental statements and agency procedures with respect to such statements will issue such supplements to these guidelines as are necessary.

(b) Agencies will continue to assess their experience in the implementation of the section 102(2)(C) provisions of the Act and in conforming with these guidelines and report thereon to the Council by June 30, 1974. Such reports should include an identification of the problem areas and suggestions for revision or clarification of these guidelines to achieve effective coordination of views on environmental aspects (and alternatives, where appropriate) of proposed actions without imposing unproductive administrative procedures. Such reports shall also indicate what progress the agency has made in developing substantial criteria and guidance for making environmental assessments as required by § 1500.6(c) of this directive and by section 102(2)(B) of the Act.

Effective date. The revisions of these guidelines shall apply to all draft and final impact statements filed with the Council after January 28, 1974.

RUSSELL E. TRAIN,
Chairman

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APPENDIX I SUMMARY TO ACCOMPANY DRAFT AND FINAL STATEMENTS

(Check one) ( ) Draft. ( ) Final Environmental Statement.

Name of responsible Federal agency (with name of operating division where appropriate). Name, address, and telephone number of individual at the agency who can be contacted for additional information about the proposed action or the statement.

1. Name of action (Check one) ( ) Administrative Action. ( ) Legislative Action.

2. Brief description of action and its purpose. Indicate what States (and counties) particularly affected, and what other proposed Federal actions in the area, if any, are discussed in the statement.

3. Summary of environmental impacts and adverse environmental effects.

4. Summary of major alternatives considered.

5. (For draft statements) List all Federal, State, and local agencies and other parties from which comments have been requested. (For final statements) List all Federal, State, and local agencies and other parties from which written comments have been received.

6. Date draft statement (and final environmental statement, if one has been issued) made available to the Council and the public.

APPENDIX II AREAS OF ENVIRONMENTAL IMPACT AND FEDERAL AGENCIES AND FEDERAL-STATE AGENCIES[1] WITH JURISDICTION BY LAW OR SPECIAL EXPERTISE TO COMMENT THEREON[2]

AIR

Air Quality

Department of Agriculture—
  Forest Service (effects on vegetation)
Atomic Energy Commission (radioactive substances)
Department of Health, Education, and Welfare
Environmental Protection Agency
Department of the Interior—
  Bureau of Mines (fossil and gaseous fuel combustion)
  Bureau of Sport Fisheries and Wildlife (effect on wildlife)
  Bureau of Outdoor Recreation (effects on recreation)
  Bureau of Land Management (public lands)
  Bureau of Indian affairs (Indian lands)
National Aeronautics and Space Administration (remote sensing, aircraft emissions)
Department of Transportation—
  Assistant Secretary for Systems Development and Technology (auto emissions)
  Coast Guard (vessel emissions)
  Federal Aviation Administration (aircraft emissions)

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[1] River Basin Commissions (Delaware, Great Lakes, Missouri, New England, Ohio, Pacific Northwest, Souris-Red-Rainy, Susquehanna, Upper Mississippi) and similar Federal-State agencies should be consulted on actions affecting the environment of their specific geographic jurisdictions.

[2] In all cases where a proposed action will have significant international environmental effects, the Department of State should be consulted, and should be sent a copy of any draft and final impact statement which covers such action.

Weather Modification

- Department of Agriculture—
  - Forest Service
- Department of Commerce—
  - National Oceanic and Atmospheric Administration
- Department of Defense—
  - Department of the Air Force
- Department of the Interior—
  - Bureau of Reclamation
- Water Resources Council

WATER

Water Quality

- Department of Agriculture—
  - Soil Conservation Service
  - Forest Service
- Atomic Energy Commission (radioactive substances)
- Department of the Interior—
  - Bureau of Reclamation
  - Bureau of Land Management (public lands)
  - Bureau of Indian Affairs (Indian lands)
  - Bureau of Sport Fisheries and Wildlife
  - Bureau of Outdoor Recreation
  - Geological Survey
  - Office of Saline Water
- Environmental Protection Agency
- Department of Health, Education, and Welfare
- Department of Defense—
  - Army Corps of Engineers
  - Department of the Navy (ship pollution control)
- National Aeronautics and Space Administration (remote sensing)
- Department of Transportation—
  - Coast Guard (oil spills, ship sanitation)
- Department of Commerce—
  - National Oceanic and Atmospheric Administration
- Water Resources Council
- River Basin Commissions (as geographically appropriate)

Marine Pollution, Commercial Fishery Conservation, and Shellfish Sanitation

- Department of Commerce—
  - National Oceanic and Atmospheric Administration
- Department of Defense—
  - Army Corps of Engineers
  - Office of the Oceanographer of the Navy
- Department of Health, Education, and Welfare
- Department of the Interior—
  - Bureau of Sport Fisheries and Wildlife
  - Bureau of Outdoor Recreation
  - Bureau of Land Management (outer continental shelf)
  - Geological Survey (outer continental shelf)
- Department of Transportation—
  - Coast Guard
- Environmental Protection Agency
- National Aeronautics and Space Administration (remote sensing)
- Water Resources Council
- River Basin Commissions (as geographically appropriate)

Waterway Regulation and Stream Modification

- Department of Agriculture—
  - Soil Conservation Service
- Department of Defense—
  - Army Corps of Engineers
- Department of the Interior—
  - Bureau of Reclamation
  - Bureau of Outdoor Recreation
  - Fish and Wildlife Service
  - Geological Survey
- Department of Transportation—
  - Coast Guard
- Environmental Protection Agency
- National Aeronautics and Space Administration (remote sensing)
- Water Resources Council
- River Basin Commissions (as geographically appropriate)

FISH AND WILDLIFE

- Department of Agriculture—
  - Forest Service
  - Soil Conservation Service
- Department of Commerce—
  - National Oceanic and Atmospheric Administration (marine species)
- Department of the Interior—
  - Bureau of Land Management
  - Bureau of Outdoor Recreation
  - Fish and Wildlife Service
- Environmental Protection Agency

SOLID WASTE

- Atomic Energy Commission (radioactive waste)
- Department of Defense—
  - Army Corps of Engineers
- Department of Health, Education, and Welfare
- Department of the Interior—
  - Bureau of Mines (mineral waste, mine acid waste, municipal solid waste, recycling)
  - Bureau of Land Management (public lands)
  - Bureau of Indian Affairs (Indian lands)
  - Geological Survey (geologic and hydrologic effects)
  - Office of Saline Water (demineralization)
- Department of Transportation—
  - Coast Guard (ship sanitation)
- Environmental Protection Agency
- River Basin Commissions (as geographically appropriate)
- Water Resources Council

NOISE

- Department of Commerce—
  - National Bureau of Standards
- Department of Health, Education, and Welfare
- Department of Housing and Urban Development (land use and building materials aspects)
- Department of Labor—
  - Occupational Safety and Health Administration

Department of Transportation—
  Assistant Secretary for Systems Development and Technology
  Federal Aviation Administration, Office of Noise Abatement
Environmental Protection Agency
National Aeronautics and Space Administration

RADIATION

Atomic Energy Commission
Department of Commerce—
  National Bureau of Standards
Department of Health, Education, and Welfare
Department of the Interior—
  Bureau of Mines (uranium mines)
  Mining Enforcement and Safety Administration (uranium mines)
Environmental Protection Agency

HAZARDOUS SUBSTANCES

Toxic Materials

Atomic Energy Commission (radioactive substances)
Department of Agriculture—
  Agricultural Research Service
  Consumer and Marketing Service
Department of Commerce—
  National Oceanic and Atmospheric Administration
Department of Defense
Department of Health, Education, and Welfare
Environmental Protection Agency

Food Additives and Contamination of Foodstuffs

Department of Agriculture—
  Consumer and Marketing Service (meat and poultry products)
Department of Health, Education, and Welfare
Environmental Protection Agency

Pesticides

Department of Agriculture—
  Agricultural Research Service (biological controls, food and fiber production)
  Consumer and Marketing Service
  Forest Service
Department of Commerce—
  National Oceanic and Atmospheric Administration
Department of Health, Education, and Welfare
Department of the Interior—
  Bureau of Sport Fisheries and Wildlife (fish and wildlife effects)
  Bureau of Land Management (public lands)
  Bureau of Indian Affairs (Indian lands)
  Bureau of Reclamation (irrigated lands)
  Fish and Wildlife Service (fish and wildlife effects)
Environmental Protection Agency

Transportation and Handling of Hazardous Materials

Atomic Energy Commission (radioactive substances)
Department of Commerce—
  Maritime Administration
  National Oceanic and Atmospheric Administration (effects on marine life and the coastal zone)

Department of Defense—
  Armed Services Explosive Safety Board
  Army Corps of Engineers (navigable waterways)
Department of Transportation—
  Federal Highway Administration, Bureau of Motor Carrier Safety
  Coast Guard
  Federal Railroad Administration
  Federal Aviation Administration
  Assistant Secretary for Systems Development and Technology
  Office of Hazardous Materials
  Office of Pipeline Safety
Environmental Protection Agency

ENERGY SUPPLY AND NATURAL RESOURCES DEVELOPMENT

Electric Energy Development, Generation, Transmission, and Use

Atomic Energy Commission (nuclear)
Department of Agriculture—
  Rural Electrification Administration (rural areas)
Department of Defense—
  Army Corps of Engineers (hydro)
Department of Health, Education, and Welfare (radiation effects)
Department of Housing and Urban Development (urban areas)
Department of the Interior—
  Bureau of Indian Affairs (Indian lands)
  Bureau of Land Management (public lands)
  Bureau of Reclamation
  Power Marketing Administration
  Geological Survey
  Bureau of Outdoor Recreation
  Fish and Wildlife Service
  National Park Service
Environmental Protection Agency
Federal Power Commission (hydro, transmission, and supply)
River Basin Commissions (as geographically appropriate)
Tennessee Valley Authority
Water Resources Council

Petroleum Development, Extraction, Refining, Transport, and Use

Department of the Interior—
  Office of Oil and Gas
  Bureau of Mines
  Geological Survey
  Bureau of Land Management (public lands and outer continental shelf)
  Bureau of Indian Affairs (Indian lands)
  Fish and Wildlife Service (effects on fish and wildlife)
  Bureau of Outdoor Recreation
  National Park Service
Department of Transportation (Transport and Pipeline Safety)
Environmental Protection Agency
Interstate Commerce Commission

Natural Gas Development, Production, Transmission, and Use

Department of Housing and Urban Development (urban areas)
Department of the Interior—
  Office of Oil and Gas
  Geological Survey

Department of the Interior—Continued
  Bureau of Mines
  Bureau of Land Management (public lands)
  Bureau of Indian Affairs (Indian lands)
  Bureau of Outdoor Recreation
  Fish and Wildlife Service
  National Park Service
Department of Transportation (transport and safety)
Environmental Protection Agency
Federal Power Commission (production, transmission, and supply)
Interstate Commerce Commission

Coal and Minerals Development, Mining, Conversion, Processing, Transport, and Use

Appalachian Regional Commission
Department of Agriculture—
  Forest Service
Department of Commerce
Department of the Interior—
  Office of Coal Research
  Mining Enforcement and Safety Administration
  Bureau of Mines
  Geological Survey
  Bureau of Indian Affairs (Indian lands)
  Bureau of Land Management (public lands)
  Bureau of Outdoor Recreation
  Fish and Wildlife Service
  National Park Service
Department of Labor—
  Occupational Safety and Health Administration
Department of Transportation
Environmental Protection Agency
Interstate Commerce Commission
Tennessee Valley Authority

Renewable Resource Development, Production, Management, Harvest, Transport, and Use

Department of Agriculture—
  Forest Service
  Soil Conservation Service
Department of Commerce
Department of Housing and Urban Development (building materials)
Department of the Interior—
  Geological Survey
  Bureau of Land Management (public lands)
  Bureau of Indian Affairs (Indian lands)
  Bureau of Outdoor Recreation
  Fish and Wildlife Service
  National Park Service
Department of Transportation
Environmental Protection Agency
Interstate Commerce Commission (freight rates)

Energy and Natural Resources Conservation

Department of Agriculture—
  Forest Service
  Soil Conservation Service

Department of Commerce—
  - National Bureau of Standards (energy efficiency)

Department of Housing and Urban Development—
  - Federal Housing Administration (housing standards)

Department of the Interior—
  - Office of Energy Conservation
  - Bureau of Mines
  - Bureau of Reclamation
  - Geological Survey
  - Power Marketing Administration

Department of Transportation
Environmental Protection Agency
Federal Power Commission
General Services Administration (design and operation of buildings)
Tennessee Valley Authority

LAND USE AND MANAGEMENT

Land Use Changes, Planning and Regulation of Land Development

Department of Agriculture—
  - Forest Service (forest lands)
  - Agricultural Research Service (agricultural lands)

Department of Housing and Urban Development
Department of the Interior—
  - Office of Land Use and Water Planning
  - Bureau of Land Management (public lands)
  - Bureau of Indian Affairs (Indian lands)
  - Bureau of Sport Fisheries and Wildlife (wildlife refuges)
  - Bureau of Outdoor Recreation (recreation lands)
  - Fish and Wildlife Service
  - National Park Service (NPS units)

Department of Transportation
Environmental Protection Agency (pollution effects)
National Aeronautics and Space Administration (remote sensing)
River Basin Commissions (as geographically appropriate)

Public Land Management

Department of Agriculture—
  - Forest Service (forests)

Department of Defense
Department of the Interior—
  - Bureau of Land Management
  - Bureau of Indian Affairs (Indian lands)
  - Bureau of Outdoor Recreation (recreation lands)
  - Fish and Wildlife Service (wildlife refuges)
  - National Park Service (NPS units)

Federal Power Commission (project lands)
General Services Administration
National Aeronautics and Space Administration (remote sensing)
Tennessee Valley Authority (project lands)

Protection of Environmentally Critical Areas—Floodplains, Wetlands, Beaches and Dunes, Unstable Soils, Steep Slopes, Aquifer Recharge Areas, etc.

Department of Agriculture—
  - Agricultural Stabilization and Conservation Service
  - Soil Conservation Service
  - Forest Service

Department of Commerce—
  National Oceanic and Atmospheric Administration (coastal areas)
Department of Defense—
  Army Corps of Engineers
Department of Housing and Urban Development (urban and floodplain areas)
Department of the Interior—
  Office of Land Use and Water Planning
  Bureau of Outdoor Recreation
  Bureau of Reclamation
  Bureau of Land Management
  Fish and Wildlife Service
  Geological Survey
Environmental Protection Agency (pollution effects)
National Aeronautics and Space Administration (remote sensing)
River Basins Commissions (as geographically appropriate)
Water Resources Council

Land Use in Coastal Areas

Department of Agriculture—
  Forest Service
  Soil Conservation Service (soil stability, hydrology)
Department of Commerce—
  National Oceanic and Atmospheric Administration (impact on marine life and coastal zone management)
Department of Defense—
  Army Corps of Engineers (beaches, dredge and fill permits, Refuse Act permits)
Department of Housing and Urban Development (urban areas)
Department of the Interior—
  Office of Land Use and Water Planning
  Fish and Wildlife Service
  National Park Service
  Geological Survey
  Bureau of Outdoor Recreation
  Bureau of Land Management (public lands)
Department of Transportation—
  Coast Guard (bridges, navigation)
Environmental Protection Agency (pollution effects)
National Aeronautics and Space Administration (remote sensing)

Redevelopment and Construction in Built-Up Areas

Department of Commerce—
  Economic Development Administration (designated areas)
Department of Housing and Urban Development
Department of the Interior—
  Office of Land Use and Water Planning
Department of Transportation
Environmental Protection Agency
General Services Administration
Office of Economic Opportunity

Density and Congestion Mitigation

Department of Health, Education, and Welfare
Department of Housing and Urban Development
Department of the Interior—
  Office of Land Use and Water Planning
  Bureau of Outdoor Recreation
Department of Transportation
Environmental Protection Agency

Neighborhood Character and Continuity

Department of Health, Education, and Welfare
Department of Housing and Urban Development
National Endowment for the Arts
Office of Economic Opportunity

Impacts on Low-Income Populations

Department of Commerce—
  Economic Development Administration (designated areas)
Department of Health, Education, and Welfare
Department of Housing and Urban Development
Office of Economic Opportunity

Historic, Architectural, and Archeological Preservation

Advisory Council on Historic Preservation
Department of Housing and Urban Development
Department of the Interior—
  National Park Service
  Bureau of Land Management (public lands)
  Bureau of Indian Affairs (Indian lands)
General Services Administration
National Endowment for the Arts

Soil and Plant Conservation and Hydrology

Department of Agriculture—
  Soil Conservation Service
  Agricultural Service
  Forest Service
Department of Commerce—
  National Oceanic and Atmospheric Administration
Department of Defense—
  Army Corps of Engineers (dredging, aquatic plants)
Department of Health, Education, and Welfare
Department of the Interior—
  Bureau of Land Management
  Fish and Wildlife Service
  Geological Survey
  Bureau of Reclamation
Environmental Protection Agency
National Aeronautics and Space Administration (remote sensing)
River Basin Commissions (as geographically appropriate)
Water Resources Council

Outdoor Recreation

Department of Agriculture—
  Forest Service
  Soil Conservation Service
Department of Defense—
  Army Corps of Engineers
Department of Housing and Urban Development (urban areas)
Department of the Interior—
  Bureau of Land Management
  National Park Service
  Bureau of Outdoor Recreation
  Bureau of Indian Affairs
  Fish and Wildlife Service
Environmental Protection Agency

National Aeronautics and Space Administration (remote sensing)
River Basin Commissions (as geographically appropriate)
Water Resources Council

APPENDIX III OFFICES WITHIN FEDERAL AGENCIES AND FEDERAL-STATE AGENCIES FOR INFORMATION REGARDING THE AGENCIES' NEPA ACTIVITIES AND FOR RECEIVING OTHER AGENCIES' IMPACT STATEMENTS FOR WHICH COMMENTS ARE REQUESTED

ADVISORY COUNCIL ON HISTORIC PRESERVATION

Office of Review and Compliance, Advisory Council on Historic Preservation, 1522 K Street, N.W., Suite 430, Washington, D.C. 20005 (202) 254-3380

DEPARTMENT OF AGRICULTURE [1]

Office of the Secretary, Attn: Coordinator Environmental Quality Activities, U.S. Department of Agriculture, Washington, D.C. 20250 (202) 447-3965

APPALACHIAN REGIONAL COMMISSION

Office of the Alternate Federal Co-Chairman, Appalachian Regional Commission, 1666 Connecticut Avenue, N.W., Washington, D.C. 20235 (202) 967-4103

DEPARTMENT OF THE ARMY (CORPS OF ENGINEERS)

Executive Director of Civil Works, Office of the Chief of Engineers, U.S. Army Corps of Engineers, Washington, D.C. 20314 (202) 693-7093

DEPARTMENT OF COMMERCE

Office of the Deputy Assistant Secretary for Environmental Affairs, U.S. Department of Commerce, Washington, D.C. 20230 (202) 967-4335

DEPARTMENT OF DEFENSE

Office of the Assistant to the Secretary of Defense for Environmental Quality, U.S. Department of Defense, Room 3D171, The Pentagon, Washington, D.C. 20301 (202) 695-3010

DELAWARE RIVER BASIN COMMISSION

Environmental Unit, Delaware River Basin Commission, Post Office Box 360, Trenton, N.J. 08603 (609) 883-9500

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[1] Requests for comments or information from individual units of the Department of Agriculture, e.g., Soil Conservation Service, Forest Service, etc. should be sent to the Office of the Secretary, Department of Agriculture, at the address given above.

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

Office of the Assistant Administrator for Environment and Safety, Energy Research and Development Administration, Washington, D.C. 20545 (202) 937-3208

ENVIRONMENTAL PROTECTION AGENCY [3]

Director, Office of Federal Activities, Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460 (202) 755-0777

FEDERAL POWER COMMISSION

Office of Energy Systems, Federal Power Commission, Room 4306, 825 North Capitol Street, N.E., Washington, D.C. 20426 (202) 386-3335

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[3] Contact the Office of Federal Activities for environmental statements concerning legislation, regulations, national program proposals or other major policy issues.

For all other EPA consultation, contact the Regional Administrator in whose area the proposed action (e.g., highway or water resource construction projects) will take place. The Regional Administrators will coordinate the EPA review. Addresses of the Regional Administrators and the areas covered by their regions are as follows:

Regional Administrator I, U.S. Environmental Protection Agency Room 2303, John F. Kennedy Federal Bldg. Boston, Mass. 02203 (617) 223-4635	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
Regional Administrator II, U.S. Environmental Protection Agency Room 908, 26 Federal Plaza New York, N.Y. 10007 (212) 264-8556	New Jersey, New York, Puerto Rico, Virgin Islands
Regional Administrator III, U.S. Environmental Protection Agency Curtis Bldg., 6th & Walnut Streets Philadelphia, Pa. 19106 (215) 597-8332	Delaware, Maryland, Pennsylvania, Virginia, West Virginia, District of Columbia
Regional Administrator IV, U.S. Environmental Protection Agency 1421 Peachtree Street, N.E. Atlanta, Ga. 30309 (404) 526-5458	Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee
Regional Administrator V, U.S. Environmental Protection Agency 230 South Dearborn Street Chicago, Ill. 60604 (312) 353-5758	Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin

(Continued)

GENERAL SERVICES ADMINISTRATION

Office of Environmental Affairs, Office of the Deputy Administrator for Special Projects, General Services Administration, Washington, D.C. 20405 (202) 343-4161

GREAT LAKES BASIN COMMISSION

Office of the Chairman, Great Lakes Basin Commission, 3475 Plymouth Road, P.O. Box 999, Ann Arbor, Michigan 48106 (313) 769-7431

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE [3]

Office of Environmental Affairs, Office of the Assistant Secretary for Administration and Management, Department of Health, Education, and Welfare, 330 Independence Avenue, S.W., Washington, D.C. 20201 (202) 245-7243

(Continued)

Regional Administrator VI, U.S. Environmental Protection Agency 1600 Patterson Street Suite 1100 Dallas, Tex. 75201 (214) 749-1237	Arkansas, Louisiana, New Mexico, Texas, Oklahoma
Regional Administrator VII, U.S. Environmental Protection Agency 1735 Baltimore Avenue Kansas City, Mo. 64108 (816) 374-2921	Iowa, Kansas, Missouri, Nebraska
Regional Administrator VIII, U.S. Environmental Protection Agency Suite 900, Lincoln Tower 1860 Lincoln Street Denver, Colo. 80203 (303) 837-4831	Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming
Regional Administrator IX, U.S. Environmental Protection Agency 100 California Street San Francisco, Calif. 94111 (415) 556-0970	Arizona, California, Hawaii, Nevada, American Samoa, Guam, Trust Territories of Pacific Islands, Wake Island
Regional Administrator X, U.S. Environmental Protection Agency 1200 Sixth Avenue Seattle, Wash. 98101 (206) 442-1595	Alaska, Idaho, Oregon, Washington

[3] Contact the Office of Environmental Affairs for information on HEW's environmental statements concerning legislation, regulations, national program proposals or other major policy issues, and for all requests for HEW comments on impact statements of other agencies.

(Continued)

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT[4]

Director, Office of Environmental Quality, Department of Housing and Urban Development, Room 7258, Washington, D.C. 20410 (202) 755-6309

(Continued)

For information with respect to HEW actions occurring within the jurisdiction of the Departments' Regional Directors, contact the appropriate Regional Environmental Officer:

Region I:
Regional Environmental Officer, U.S. Department of Health, Education, and Welfare, John F. Kennedy Center, Room E-311, Boston, Mass. 02203 (617) 223-5485

Region II:
Regional Environmental Officer, U.S. Department of Health, Education, and Welfare, 26 Federal Plaza, Room 3309, New York, N.Y. 10007 (212) 264-4483

Region III:
Regional Environmental Officer, U.S. Department of Health, Education, and Welfare, P.O. Box 13716, Philadelphia, Pa. 19101 (215) 597-6476

Region IV:
Regional Environmental Officer, U.S. Department of Health, Education, and Welfare, 50 Seventh Street, N.E., Room 447, Atlanta, Ga. 30323 (404) 526-5048

Region V:
Regional Environmental Officer, U.S. Department of Health, Education, and Welfare, 300 South Wacker Drive, 35th floor, Chicago, Ill. 60606 (312) 353-1670

Region VI:
Regional Environmental Officer, U.S. Department of Health, Education, and Welfare, 1114 Commerce Street, Room 925, Dallas, Tex. 75202 (214) 749-7741

Region VII:
Regional Environmental Officer, U.S. Department of Health, Education, and Welfare, 601 East 12th Street, Kansas City, Mo. 64106 (816) 374-5912

Region VIII:
Regional Environmental Officer, U.S. Department of Health, Education, and Welfare, 1916 Stout Street, 10th floor, Denver, Colo. 80202 (303) 837-2875

Region IX:
Regional Environmental Officer, U.S. Department of Health, Education, and Welfare, 50 Fulton Street, Room 410, San Francisco, Calif. 94102 (415) 556-3687

Region X:
Regional Environmental Officer, U.S. Department of Health, Education, and Welfare, 1321 Second Street, Mail Stop 610, Seattle, Wash. 98101 (206) 442-7790

[4] Contact the Director with regard to environmental impacts of legislation, policy statements, program regulations and procedures, and precedent-making project decisions. For all other consultation, contact the HUD Regional Administrator in whose jurisdiction the project lies, as follows:

Regional Administrator I, Environmental Clearance Officer, U.S. Department of Housing and Urban Development, John F. Kennedy Federal Building, Room 405, Boston, Mass. 02203 (617) 223-4347

(Continued)

DEPARTMENT OF THE INTERIOR[5]

Director, Office of Environmental Project Review, Department of the Interior, Interior Building, Washington, D.C. 20240 (202) 343-3891

INTERSTATE COMMERCE COMMISSION

Office of Proceedings, Environmental Section, Interstate Commerce Commission, Washington, D.C. 20423 (202) 343-7966

DEPARTMENT OF LABOR

Office of Manpower for Policy Evaluation and Research, Division of Manpower Policy and Planning, Department of Labor, 601 D Street, N.W., Washington, D.C. 20210 (202) 376-6274

MISSOURI RIVER BASIN COMMISSION

Office of the Chairman, Missouri River Basin Commission, 10050 Regency Circle, Omaha, Nebr. 68114 (402) 397-5714

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Office of Policy Analysis, National Aeronautics and Space Administration, 400 Maryland Avenue, Washington, D.C. 20546 (202) 755-8433

(Continued)

Regional Administrator II, Environmental Clearance Officer, U.S. Department of Housing and Urban Development, 26 Federal Plaza, New York, N.Y. 10007 (212) 264-4197

Regional Administrator III, Environmental Clearance Officer, U.S. Department of Housing and Urban Development, Curtis Building, Sixth and Walnut Streets, Philadelphia, Pa. 19106 (215) 597-2520

Regional Administrator IV, Environmental Clearance Officer, U.S. Department of Housing and Urban Development, Pershing Point Plaza, 1371 Peachtree Street, N.E., Atlanta, Ga. 30309 (404) 526-3521

Regional Administrator V, Environmental Clearance Officer, U.S. Department of Housing and Urban Development, 300 South Wacker Drive, Chicago, Ill. 60606 (312) 353-1680

Regional Administrator VI, Environmental Clearance Officer, U.S. Department of Housing and Urban Development, U.S. Courthouse, 1100 Commerce Street, Dallas, Tex. 75202 (214) 749-7466

Regional Administrator VII, Environmental Clearance Officer, U.S. Department of Housing nad Urban Development, 911 Walnut Street, Kansas City, Mo. 64106 (816) 374-3191

Regional Administrator VIII, Environmental Clearance Officer, U.S. Department of Housing and Urban Development, 1961 Stout Street, Denver, Colo. 80202 (303) 837-3811

Regional Administrator IX, Environmental Clearance Officer, U.S. Department of Housing and Urban Development, 450 Golden Gate Avenue, P.O. Box 36003, San Francisco, Calif. 94102 (415) 556-5720

Regional Administrator X, Environmental Clearance Officer, U.S. Department of Housing and Urban Development, 1321 Second Avenue, Seattle, Wash. 98101 (206) 442-7790

[5] Requests for comments or information from individual units of the Department of the Interior should be sent to the Office of Environmental Project Review at the address given above.

NATIONAL CAPITAL PLANNING COMMISSION

Office of Environmental Affairs, National Capital Planning Commission, Washington, D.C. 20576 (202) 382-7200

NATIONAL ENDOWMENT FOR THE ARTS

Office of the Director, Architecture and Environmental Arts Program, National Endowment for the Arts, Washington, D.C. 20506 (202) 634-4276

NEW ENGLAND RIVER BASIN COMMISSION

Office of the Chairman, New England River Basin Commission, 55 Court Street, Boston, Mass. 02108 (617) 223-6244

NUCLEAR REGULATORY COMMISSION

For Nuclear Power Plants: Office of the Assistant Director for Environmental Projects, Division of Nuclear Reactor Licensing, Nuclear Regulatory Commission, Washington, D.C. 20555 (202) 443-6965

For Fuel-cycle Projects: Fuel-cycle Environmental Projects Branch, Division of Materials and Fuel-cycle Facility Licensing, Nuclear Regulatory Commission, Washington, D.C. 20555 (202) 492-7631

OHIO RIVER BASIN COMMISSION

Office of the Chairman, Ohio River Basin Commission, 36 East 4th Street, Suite 208, Cincinnati, Ohio 45202 (513) 684-3831

PACIFIC NORTHWEST RIVER BASIN COMMISSION

Office of the Chairman, Pacific Northwest River Basin Commission, Post Office Box 908, Vancouver, Wash. 98660 (206) 694-2581

SOURIS-RED-RAINY RIVER BASINS COMMISSION

Office of the Chairman, Souris-Red-Rainy River Basins Commission, Suite 6, Professional Building, Holiday Mall, Moorhead, Minnesota 56560 (701) 237-5227

DEPARTMENT OF STATE

Office of Environmental Affairs, Room 7822, Department of State, Washington, D.C. 20520 (202) 632-9278

SUSQUEHANNA RIVER BASIN COMMISSION

Office of the Executive Director, Susquehanna River Basin Commission, 5012 Lenker Street, Mechanicsburg, Pa. 17055 (717) 737-0501

TENNESSEE VALLEY AUTHORITY

Office of the Chief of Environmental Assessment and Compliance Staff, Tennessee Valley Authority, 267—401 Building, Chattanooga, Tenn. 37401 (615) 755-3175

DEPARTMENT OF TRANSPORTATION [a]

Director, Office of Environmental Affairs, Office of the Assistant Secretary for Environment, Safety, and Consumer Affairs, Department of Transportation, Washington, D.C. 20590 (202) 426-4357

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[a] Contact the Office of Environmental Quality, Department of Transportation, for information on DOT's environmental statements concerning legislation, regulations, national program proposals, or other major policy issues.

For information regarding the Department of Transportation's other environmental statements, contact the national office for the appropriate administration:

U.S. Coast Guard

Office of Ports and Waterways Planning, U.S. Coast Guard, 400 Seventh Street, S.W., Washington, D.C. 20590 (202) 426-8722

Federal Aviation Administration

Office of Environmental Quality, Federal Aviation Administration, 800 Independence Avenue, S.W., Washington, D.C. 20591 (202) 426-8722

Federal Highway Administration

Office of Environmental Policy, Environmental Programs Division, Federal Highway Administration, 400 Seventh Street, S.W., Washington, D.C. 20590 (202) 426-0106

Federal Railroad Administration

Office of the Chief Counsel, Federal Railroad Administration, 400 Seventh Street, S.W., Washington, D.C. 20590 (202) 426-0767

Urban Mass Transportation Administration

Capitol Assistance, Urban Mass Transportation Administration, 400 Seventh Street, S.W., Washington, D.C. 20590 (202) 426-1985

For other administrations not listed above, contact the Office of Environmental Quality, Department of Transportation, at the address given above.

For comments on other agencies' environmental statements, contact the appropriate administration's regional office. If more than one administration within the Department of Transportation is to be requested to comment, contact the Secretarial Representative in the appropriate Regional Office for coordination of the Department's comments:

Secretarial Representative

Region I Secretarial Representative, U.S. Department of Transportation, Transportation Systems Center, 55 Broadway, Cambridge, Mass. 02142 (617) 494-2709

Region II Secretarial Representative, U.S. Department of Transportation, 26 Federal Plaza, Room 1811, New York, N.Y. 10007 (212) 264-2672

Region III Secretarial Representative, U.S. Department of Transportation, 434 Walnut Street, 10th floor, Philadelphia, Pa. 19106 (215) 597-9430

Region IV Secretarial Representative, U.S. Department of Transportation, Suite 515, 1720 Peachtree Rd., N.W., Atlanta, Ga. 30309 (404) 526-3738

Region V Secretarial Representative, U.S. Department of Transportation, 17th Floor, 300 S. Wacker Drive, Chicago, Ill. 60606 (312) 353-4000

Region VI Secretarial Representative, U.S. Department of Transportation, 9-C-18 Federal Center, 1100 Commerce Street, Dallas, Tex. 75202 (214) 749-1851

Region VII Secretarial Representative, U.S. Department of Transportation, 601 East 12th Street, Room 634, Kansas City, Mo. 64106 (816) 374-5801

Region VIII Secretarial Representative, U.S. Department of Transportation, Prudential Plaza, Suite 1822, 1050 17th Street, Denver, Colo. 80202 (303) 837-3242

(Continued)

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Region IX Secretarial Representative, U.S. Department of Transportation, 450 Golden Gate Avenue, Box 36133, San Francisco, Calif. 94102 (415) 556-5961

Region X Secretarial Representative, U.S. Department of Transportation, 3112 Federal Building, 915 Second Street, Seattle, Wash. 98174 (206) 442-0590

Federal Aviation Administration

New England Region, Office of the Regional Director, Federal Aviation Administration, 12 Northeast Executive Park, Burlington, Mass. 01803 (617) 467-7244

Eastern Region, Office of the Regional Director, Federal Aviation Administration, Federal Building, JFK International Airport, Jamaica, N.Y. 11430 (212) 995-3333

Southern Region, Office of the Regional Director, Federal Aviation Administration, P.O. Box 20636, Atlanta, Ga. 30320 (404) 526-7222

Great Lakes Region, Office of the Regional Director, Federal Aviation Administration, 2300 East Devon, Des Plaines, Ill. 60018 (312) 694-4500

Southwest Region, Office of the Regional Director, Federal Aviation Administration, P.O. Box 1689, Fort Worth, Tex. 76101 (817) 624-4911

Central Region, Office of the Regional Director, Federal Aviation Administration, 601 East 12th Street, Kansas City, Mo. 64106 (816) 374-5626

Rocky Mountain Region, Office of the Regional Director, Federal Aviation Administration, Park Hill Station, P.O. Box 7213, Denver, Colo. 80207 (303) 837-3646

Western Region, Office of the Regional Director, Federal Aviation Administration, P.O. Box 92007, Worldway Postal Center, Los Angeles, Calif. 90009 (213) 536-6435

Northwest Region, Office of the Regional Director, Federal Aviation Administration, FAA Building, 9010 East Marginal Way South, King County International Airport, Seattle, Wash. 98108 (206) 767-2780

Federal Highway Administration

Region 1:
Regional Administrator, Federal Highway Administration, 4 Normanskill Boulevard, Delmar, N.Y. 12054 (518) 472-6476

Region 3:
Regional Administrator, Federal Highway Administration, George H. Fallon Federal Office Building, Room 1633, 31 Hopkins Plaza, Baltimore, Md. 21201 (301) 962-2361

Region 4:
Regional Administrator, Federal Highway Administration, 1720 Peachtree Road, N.W., Suite 200, Atlanta, Ga. 30309 (404) 526-5078

Region 5:
Regional Administrator, Federal Highway Administration, 18209 Dixie Highway, Homewood, Ill. 60430 (312) 799-6300

Region 6:
Regional Administrator, Federal Highway Administration, 819 Taylor Street, Fort Worth, Tex. 76102 (817) 334-3232

Region 7:
Regional Administrator, Federal Highway Administration, P.O. Box 7186, Country Club Station, Kansas City, Mo. 64113 (816) 926-7563

(Continued)

UPPER MISSISSIPPI RIVER BASIN COMMISSION

Office of the Chairman, Upper Mississippi River Basin Commission, Federal Office Building, Room 510, Fort Snelling, Twin Cities, Minn. 55111 (612) 725-4690

WATER RESOURCES COUNCIL

Office of the Assistant Director, Planning Division, Water Resources Council, 2120 L Street, N.W., Suite 800, Washington, D.C. 20037 (202) 254-6442

(Continued)

Region 8:
Regional Administrator, Federal Highway Administration, Building 40, Room 242, Denver Federal Center, Denver, Colo. 80225 (303) 236-4051

Region 9:
Regional Administrator, Federal Highway Administration, 450 Golden Gate Avenue, Box 36112, San Francisco, Calif. 94102 (415) 556-6415

Region 10:
Regional Administrator, Federal Highway Administration, Mohawk Building, Room 412, 222 Southwest Morrison Street, Portland, Oreg. 97204 (503) 221-2065

Urban Mass Transportation Administration

Region I, Office of the UMTA Representative, Urban Mass Transportation Administration, Transportation Systems, Kendall Square, Cambridge, Mass. 02142 (617) 494-2005

Region II, Office of the UMTA Representative, Urban Mass Transportation Administration, 26 Federal Plaza, Suite 507, New York, N.Y. 10007 (212) 264-8162

Region III, Office of the UMTA Representative, Urban Mass Transportation Administration, 434 Walnut Street, 10th floor, Philadelphia, Pa. 19106 (215) 597-8098

Region IV, Office of UMTA Representative, Urban Mass Transportation Administration, 1720 Peachtree Road, Northwest, Suite 501, Atlanta, Ga. 30309 (404) 526-3948

Region V, Office of the UMTA Representative, Urban Mass Transportation Administration, 300 South Wacker Drive, Suite 700, Chicago, Ill. 60606 (312) 353-6005

Region VI, Office of the UMTA Representative, Urban Mass Transportation Administration, Federal Center, Suite 9A32, 819 Taylor Street, Fort Worth, Tex. 76102 (817) 334-3896

Region VII, Office of the UMTA Representative, Urban Mass Transportation Administration, Suite 633, 601 East 12th Street, Kansas City, Mo. 64106 (816) 374-5845

Region VIII, Office of the UMTA Representative, Urban Mass Transportation Administration, Prudential Plaza, Suite 1822, 1050 17th Street, Denver, Colo. 80202 (303) 837-3242

Region IX, Office of the UMTA Representative, Urban Mass Transportation Administration, 450 Golden Gate Avenue, Box 36125, San Francisco, Calif. 94102 (415) 556-2884

Region X, Office of the UMTA Representative, Urban Mass Transportation Administration, Federal Building, Suite 3106, 915 Second Avenue, Seattle, Wash. 98174 (206) 442-4210

APPENDIX IV STATE AND LOCAL AGENCY REVIEW OF IMPACT STATEMENTS

1. OMB Circular No. A–95 through its system of clearinghouses provides a means for securing the views of State and local environmental agencies, which can assist in the preparation of impact statements. Under A–95, review of the proposed project in the case of federally assisted projects (Part I of A–95) generally takes place prior to the preparation of the impact statement. Therefore, comments on the environmental effects of the proposed project that are secured during this stage of the A–95 process represent inputs to the environmental impact statement.

2. In the case of direct Federal development (Part II of A–95), Federal agencies are required to consult with clearinghouses at the earliest practicable time in the planning of the project or activity. Where such consultation occurs prior to completion of the draft impact statement, comments relating to the environmental effects of the proposed action would also represent inputs to the environmental impact statement.

3. In either case, whatever comments are made on environmental effects of proposed Federal or federally assisted projects by clearinghouses, or by State and local environmental agencies through clearinghouses, in the course of the A–95 review should be attached to the draft impact statement when it is circulated for review. Copies of the statement should be sent to the agencies making such comments. Whether those agencies then elect to comment again on the basis of the draft impact statement is a matter to be left to the discretion of the commenting agency depending on its resources, the significance of the project, and the extent to which its earlier comments were considered in preparing the draft statement.

4. The clearinghouses may also be used, by mutual agreement, for securing reviews of the draft environmental impact statement. However, the Federal agency may wish to deal directly with appropriate State or local agencies in the review of impact statements because the clearinghouses may be unwilling or unable to handle this phase of the process. In some cases, the Governor may have designated a specific agency, other than the clearinghouse, for securing reviews of impact statements. In any case, the clearinghouses should be sent copies of the impact statement.

5. To aid clearinghouses in coordinating State and local comments, draft statements should include copies of State and local agency comments made earlier under the A–95 process and should indicate on the summary sheet those other agencies from which comments have been requested, as specified in Appendix I of the CEQ Guidelines.

APPENDIX I

MEMBERS AND STAFF OF THE COUNCIL ON ENVIRONMENTAL QUALITY*

MEMBERS

Charles Warren, *Chairman*
James Gustave Speth, *Member*
Marion Edey, *Member-Designate*

STAFF

Steven D. Jellinek, *Director*

Eugene H. Able
Patricia Adams
Julia Alessio
Malcolm F. Baldwin
Margaret C. Battle
Janet L. Bearden
George M. Bennsky
Paul F. Bente, Jr.
Gerard A. Bertrand
Gerald L. Brubaker
Bernice Carney
Edwin H. Clark
Yvonne R. Countee
John A. Davidson
Thomas J. Delaney
Odelia L. Doggette
Barry R. Flamm
Katherine B. Gillman
Warren T. Greenleaf
Jacques Gros
Margaret M. Gugino
Lonie Hassel
Caroline Isber
Christy L. Jacobson
Ballard Jamieson
Kay Jones
Michael J. Kane
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Marilyn W. Klein
C. Foster Knight
Sally Mallison
James J. Mandros
Mary Jane Markley
Muriel L. Montgomery
Warren R. Muir
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Louise Neely
Janet A. Peck
Helen Z. Rebholz
Stuart V. Redfield
James J. Reisa, Jr.
Robert B. Smythe
Grace R. Sorel
E. Zell Steever
Deborah L. Streeter
Marion P. Suter
Lee M. Talbot
David Tundermann
Kenneth S. Weiner
M. Gayle Wilkins
Norman L. Williams
Nicholas C. Yost

INTERNS

Richard Carlston
William H. Chapman
Celia Y. C. Chen
Patrick Donohue
Michael Gantick
Nancy Gettens
Cynthia Giles
Mark S. Goldstein
Mary Gompers
Patricia Hammel
Karen Hayes
Anne L. Kirby
Terrence F. Knight
Alan Kruglak
Kenneth W. Lebensold
Lucinda Low
John Maxwell
Ricardo Notini
Nancy Peretsman
Steven Robischaud
Linda Rodgers
Kathryn L. Russell
James Spaanstra
Allen W. Staver
Neil H. Stoloff
Delelegne Tirfie
Rachel Willis

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*As of July 1977.

PHOTO CREDITS

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12	U.S. Bureau of Sport Fisheries and Wildlife, Sandy Hook Marine Laboratory, J. Chess
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28	U.S. Department of the Interior, Bureau of Land Management
43	U.S. Environmental Protection Agency, Documerica, David Harvey
51	U.S. Environmental Protection Agency, Documerica, Ken Heyman
55	Georgia-Pacific Corp.
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105	The Conservation Foundation
109	The Conservation Foundation

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